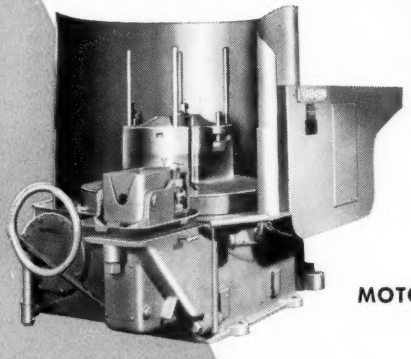
WIRE AND WIRE PRODUCTS

JULY 1953

Vaughn®

"Quick on the Draw"

WIRE DRAWING MACHINERY



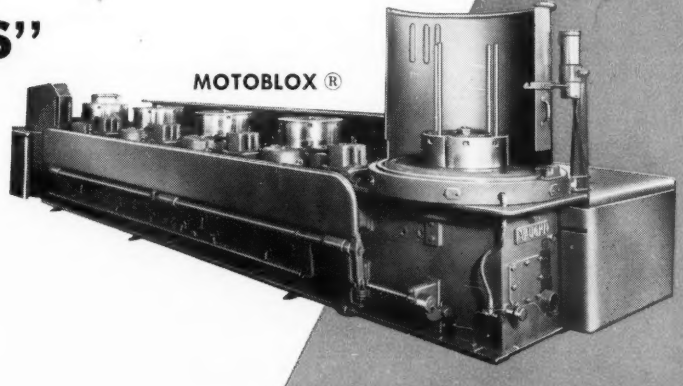
MOTOBLOC ®

RINGBLOX ®

"SMOOTH OPERATORS"

Everyone!

MOTOBLOX ®



The smooth, high-speed performance of Vaughn Wire Drawing Machinery speaks for the design and manufacturing superiority that serves you best—under all production conditions. ● The fine points are interesting. Let's discuss them with you!

THE VAUGHN MACHINERY CO.

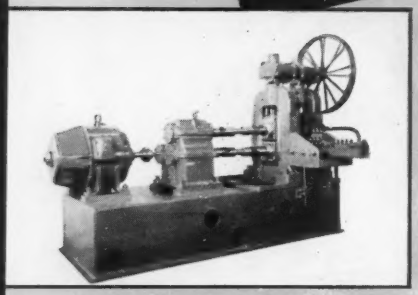
CUYAHOGA FALLS, OHIO, U.S.A.

COMPLETE COLD DRAWING EQUIPMENT . . . Continuous or Single Hole . . . for the Largest Bars and Tubes . . . for the Smallest Wire . . . Ferrous, Non-Ferrous Materials or their Alloys.

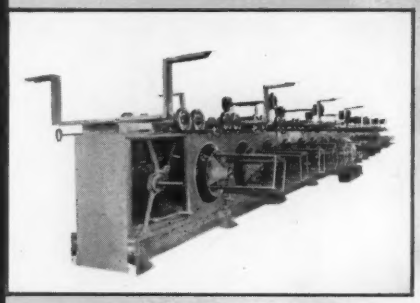
OFFICIAL PUBLICATION OF THE WIRE ASSOCIATION

LOOK TO Wean FOR WIRE MACHINERY

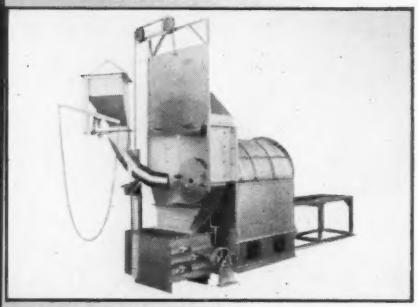
Process OR Product



2—Hi Wire Flattening Mill



Wire Galvanizing Take-Up Frame

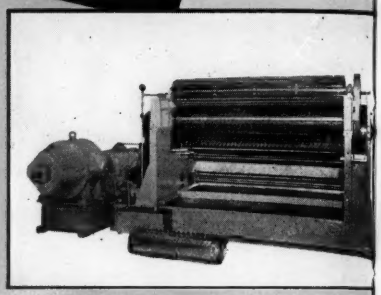


Nail Galvanizing Unit

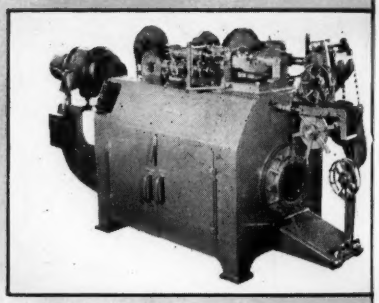
In the past few years tremendous progress has been experienced in the field of wire machinery. Production speeds have been tripled and quadrupled. Product quality has been greatly improved. Machines have been made easier to operate and maintain.

The Wean Equipment Corporation has been a large contributor to this advancement. Wean wire mill specialists have designed, built, and installed wire mill equipment for the leading wire producers the world over. If you make wire you should look to Wean for the best in machinery, service, and facilities.

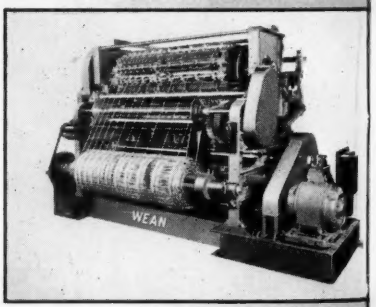
STRIP MACHINERY



Hexagon Netting Machine



2 or 4—Point Barbed Wire Machine



Hinge — Joint Fence Machine

Wean Equipment Corporation
CLEVELAND, OHIO

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(ANSWER NUMBER 1)

NEW METALS FOR AN ATOMIC AGE

"PIONEERS OF THE *UNCOMMON*" IN METALLURGY

For 64 years we have been pioneering in the research, development and production of special purpose steels and, more recently, powdered metals.

Not content to become just another tonnage producer of established grades, Firth Sterling has successfully paced the field in *anticipating* the requirements of science and industry, so that the exactly *right* metal is *ready* when a new need arises.

Now, in an era of jet engines and atomic power, Firth Sterling *has* the necessary high temperature alloys and cermets, Firth heavy metal, chromium carbides, zirconium alloys, and stainless specialties . . . as well as both new and conventional grades of high speed steels, tool and die steels, and sintered tungsten carbides.

To accomplish this metallurgical preparedness, research at Firth Sterling had to be expanded several fold. The best of new American and European processes and equipment were blended into integrated production facilities. The metallurgical brains of the world are "picked" regularly by consultation with Firth Sterling's international panel of renowned scientists and engineers.

The job is done, for today, yet *even* today we are already working on the metallurgical needs of tomorrow.

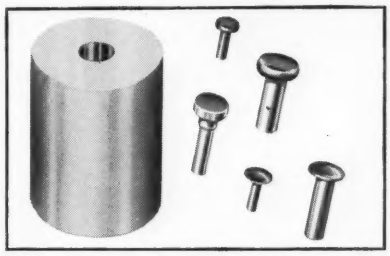
Your inquiries are invited.

Firth Sterling Stands for Metallurgical Achievement—Past, Present, Future

DIE SPECIALISTS to the WIRE INDUSTRY

A COMPLETE LINE . . . CARBIDE AND STEEL

Firth Sterling offers wire manufacturers and fabricators the advantages of a *single* source of supply of materials for both tungsten carbide and tool steel drawing, shaping, forming and heading dies. This *complete* line, from famous Firthaloy, for maximum performance where carbide is a requirement, through almost one hundred grades of high speed and tool steels for cut-off knives, roll guides, die casings,

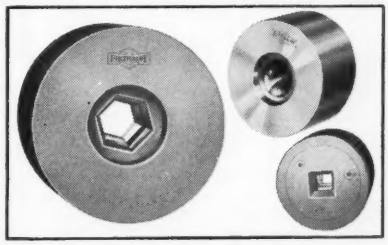


Carbide or steel heading dies—choose from the *complete* line which material best suits your needs.

forming rolls and similar applications, saves you time and money.

Standard items are available from warehouse stocks; others may be obtained from your local tool and diemaker.

Firth Sterling representatives are skilled in interpreting the needs of the wire industry and in suggesting the exactly right



Round, square, hex or specials—in carbide or steel as drawing requirements may indicate.

steel or carbide for specific applications. Because they know and sell both, you can depend on their unbiased recommendations to result in better, more economical tooling.

P-4

Firth Sterling

—INC—

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Tool & Die Steels
Stainless Specialties
High Temperature Alloys
Sintered Tungsten Carbides
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Chromium Carbides
High Temperature Cermets

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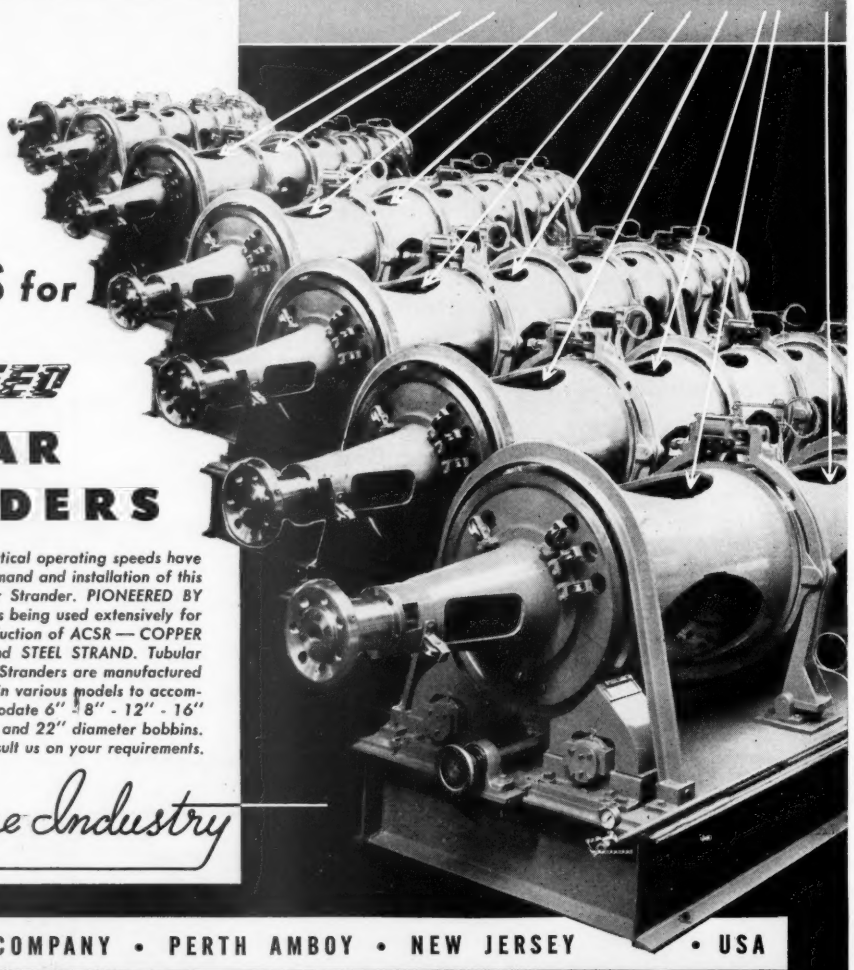
HIGH SPEED TUBULAR STRANDERS

Faster, practical operating speeds have been proven by the increased demand and installation of this improved type of Tubular Strander. PIONEERED BY SYNCRO — This equipment is being used extensively for the production of ACSR — COPPER and STEEL STRAND. Tubular Stranders are manufactured in various models to accommodate 6" - 8" - 12" - 16" and 22" diameter bobbins. Consult us on your requirements.

Machinery for the Wire Industry



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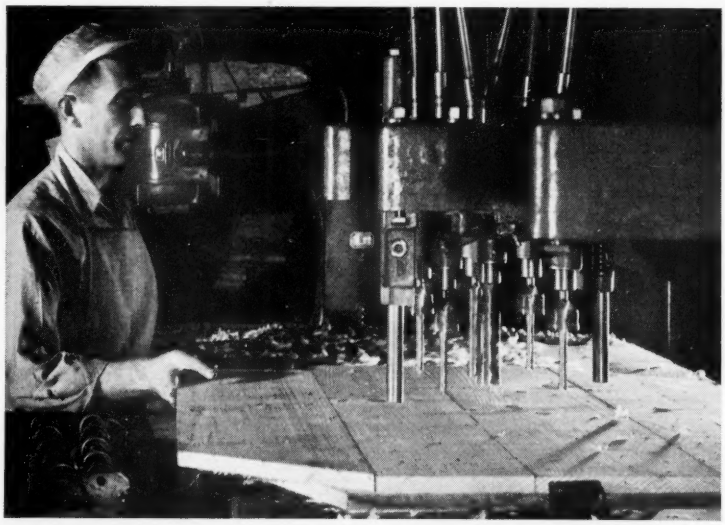
WOOD REELS
for
CABLE, ROPE
and
WIRE

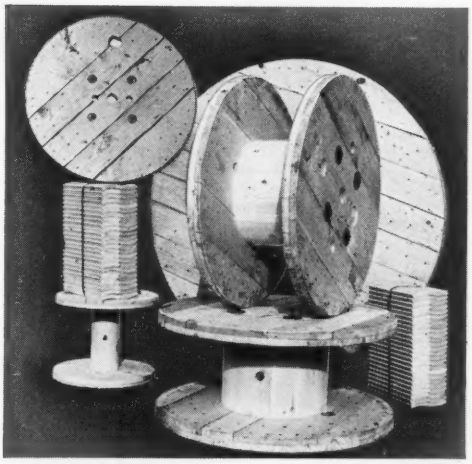


Above: BORING MACHINE

ALL SIZES AND TYPES OF SHIPPING AND SHOP REELS

12" to 96" in diameter. Knocked down or assembled. Returnable or non-returnable. Wood heads for steel drums.

REELS made by **BRIDGE** are of precision construction produced for each customer to his own specifications. They are rugged and will withstand severe handling, yet they cost you no more than ordinary reels. Our modern plant, with much equipment specially built for us, together with our straight-line production methods, assure you of the best at the lowest cost.



PLUS A SPEEDY SHIPPING SERVICE

Bridge delivers by truck to your door within a radius of 200 miles from the plant. Fast freight will bring you Bridge reels in 5 days or less east of the Mississippi.

Let us quote on your reel needs. Send your specifications. Better yet, visit our plant and see how and why our reels are made so well at so low a cost.

Make More MONEY

MORGAN CONNOR

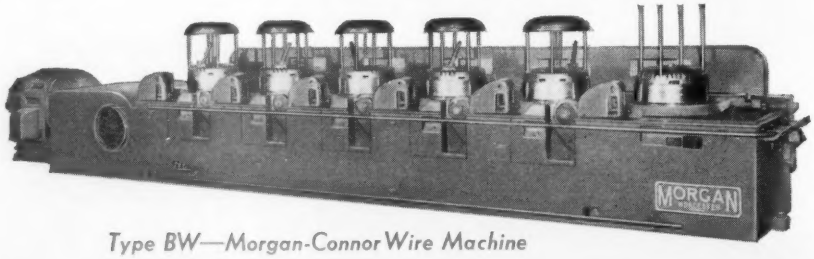
MODERN Morgan-Connor Wire Machines now make it possible to draw wire of all grades faster than ever before. Why? Because recent scientific tests have resulted in more efficient air cooling . . . permitting high drawing speeds without building up high wire temperatures.

Before you invest be sure to get the story on the new Morgan-Connor Wire Machines with the more efficient air cooling system.

WM-74

WIRE MACHINES

ROLLING MILLS
MORGOIL BEARINGS
REGENERATIVE FURNACE CONTROLS
AIR EJECTORS
PRODUCER GAS MACHINES



Type BW—Morgan-Connor Wire Machine

MORGAN CONSTRUCTION COMPANY • WORCESTER, MASSACHUSETTS

WIRE AND WIRE PRODUCTS*

Reg. U. S. Pat. Off.

A monthly publication devoted to the production of Wire, Rod and Strip, Wire and Rod Products and Insulated Wire and Cable.

DRAWING — ROLLING — EXTRUDING — FORMING — FABRICATING

Vol. 28 JULY, 1953 No. 7

Designated as Official Publication By The Wire Association

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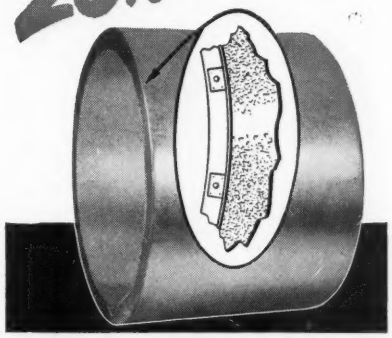

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FLANGED STEEL TRAVERSES
for wire and cable

. . . have extra strength where it is needed most—at bolt holes and base of the flange. This reinforcing makes possible the use of lighter gauge steel, saving up to 20% in weight while increasing overall strength.

Niles Flanged Steel Traverses have given as much as sixteen years' service without refinishing or major maintenance, according to actual experience records. In many cases their use has doubled the number of trips per reel before cut downs or scrapping of wooden heads.

They are manufactured in sizes up to 56" diameter and 48" traverse —in plain, painted or hot dip galvanized finishes—as light as 18-gauge steel. Width of flange and number of bolt and drain holes are furnished to your specifications. Available for prompt delivery. Write for prices.

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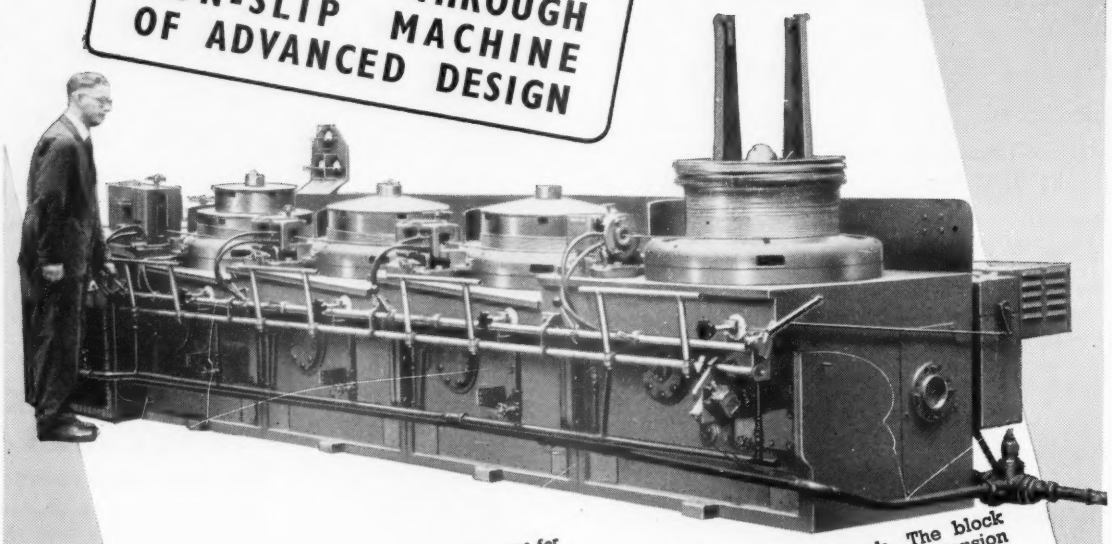
NILES, OHIO

The PATHFINDER

A STRAIGHT THROUGH NON-SLIP MACHINE OF ADVANCED DESIGN



Special 4/5 Block Pathfinder Type 22/40 for drawing mild steel from 5 s.w.g. at speeds up to 2,250 feet per minute.

1. The wire passes straight through the machine from block to block. The block speeds are automatically regulated by our patented electrical gear. Wire tension between blocks can be independently set.
2. Tilted blocks enable sufficient wire to be accumulated on each block to allow for ample cooling and yet pass through the die to the bottom of the following block in a straight line.
3. Almost infinite drafting can be obtained at each die.
4. The machine is ideal for use with a heavy spooler carrying up to about two tons of finished wire.
5. Owing to the absence of all guide pulleys, multi-holing from very heavy inlets is perfectly feasible.
6. A standard FIVE BLOCK Heavy machine is available for high carbon with the following specification:

	Type 30/60
Block Diameter.	30"
Maximum inlet.	.500"
Finish.	.250"—.102"
Drawing Speeds.	600—1200 feet per minute.

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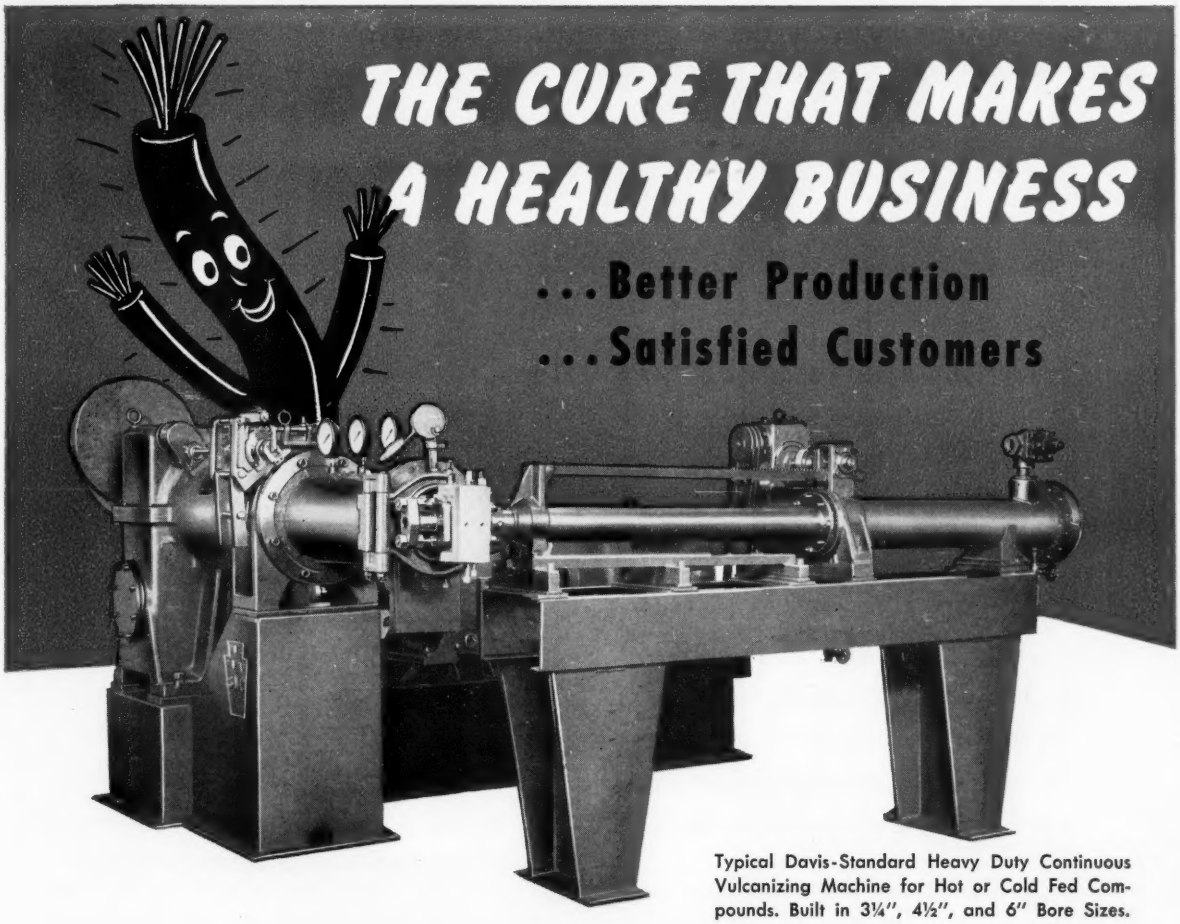

Typical Davis-Standard Heavy Duty Continuous Vulcanizing Machine for Hot or Cold Fed Compounds. Built in 3¼", 4½", and 6" Bore Sizes.

Insulated wire that is cured in a Davis-Standard Continuous Vulcanizer has a long and useful life expectancy. Its inherent stamina enables it to win loyal customers and build a healthy business for the wire manufacturer.

Equally important to the manufacturer are the ease, speed, and dependability with which the Davis-Standard Continuous Vulcanizer administers the cure. The machine is easy to set to the precise temperatures and conditions required by today's coatings, and will operate indefinitely in the severest service, without adjustment or shutdown.

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Our engineers welcome the opportunity to work with yours.

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STANDARD'S field men are all wire drawing *specialists,* equipped with that experience and knowledge of the practical side of wire drawing that enables men to render the competent service so sorely needed.

STANDARD, for instance, has some 75 compound formulas, each designed for a special application.

Even for bright wire, STANDARD has 5 different compounds. Only competent experts who know wire and lubricant properties can advise where and how to use them for best results.

In buying from STANDARD you can ask for and get that plus value called "SERVICE." This service will help you select the *right* compound for the wire to be drawn and the conditions under which you operate.

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But, if you need a special kind of wire, we can supply that too. Our modern plant facilities enable us to draw wire to meet the exact specifications of a special order, and our trained metallurgists are always ready to assist you with any manufacturing problems you may have.

We've been in the wire-making business more than one hundred years, and all of our experience is at *your* service . . . to help you do an easier and better fabrication job.

If you make it of wire... make it of the best!

U·S·S AMERICAN MANUFACTURERS WIRE

AMERICAN MANUFACTURERS WIRE

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AMERLOY—*alloy heading wire.*

AMERTEMP—*heavy-duty oil-tempered wire.*

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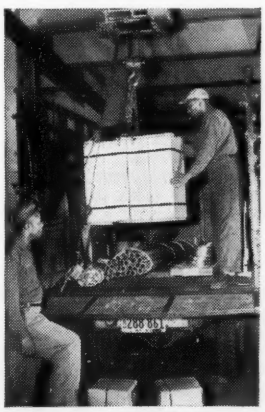
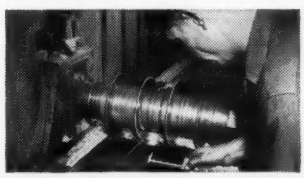
Chicago	Detroit	Milwaukee	Philadelphia	San Francisco	only)



Deliveries to your factory by truck, rail or express, if desired.



Close tolerance sawing, slitting, shearing to your specifications.

Stocks of tube, rod, bar, strip, sheet and wire in a variety of alloys.

WIREMEN...

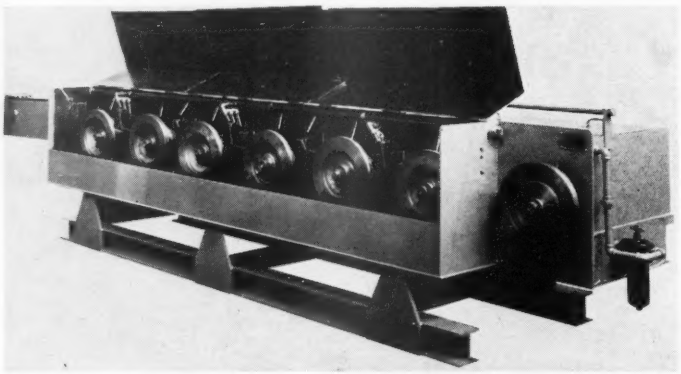
LOOK BEFORE YOU BUY

If you are thinking of enlarging your present plant capacity by the purchase of additional rod breakdown equipment, you owe it to yourself to investigate the many worthwhile features of the Cook High Speed Rod Breakdown equipment.

Cook Manufacturing Company builds a complete line of Rod equipment for all non-ferrous metals. These include 9, 13, and 17 die machines. The performance characteristics of this equipment are indicated in the table at the right.

Max. No. of Dies	Max. Entering Wire Size	Min. Finish Wire Size	Max. Finishing Speed
17	5/16″ Dia.	B&S #19	5000 FPM
13	5/16″ Dia.	B&S #16	3200 FPM
9	3/8″ Dia.	B&S #12	1700 FPM

Shown below is the front view of the Cook 13 die machine excluding the take-up spooler. Note the rugged all-welded construction.



This machine is designed for long life and ease of string-up. All capstans have replaceable hard metal wearing bands. A forced feed lubricating system assures a full and complete flow of oil to all vital parts. The capstans are driven by pre-loaded chain which eliminates idler pulleys. Chain stretch has been eliminated and the machine is built to give long and continuous 24 hour service with a minimum of maintenance.

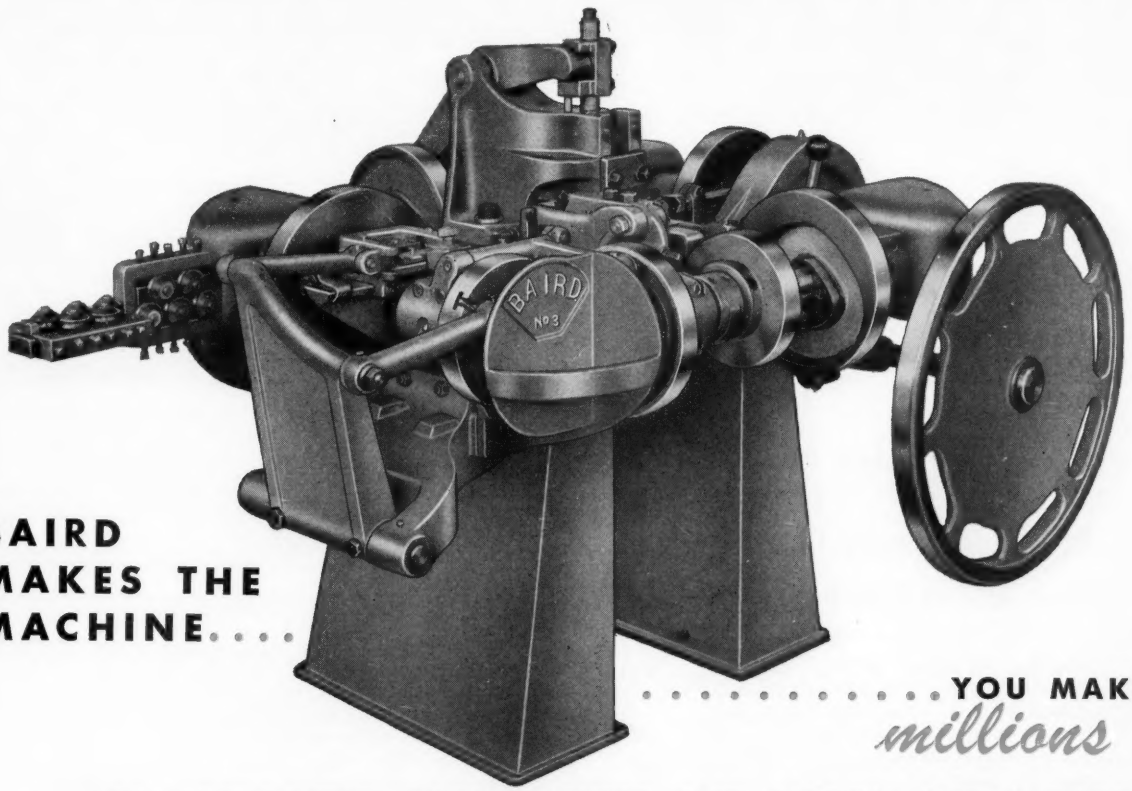
Write today for descriptive literature giving details of construction and performance of this high speed heavy duty Rod Breakdown Equipment.

COOK MANUFACTURING COMPANY

265 NORTH 9th STREET **PATERSON 2, N. J.**

ASK BAIRD ABOUT IT!

HIGH PRODUCTION TOOLING



BAIRD MAKES THE MACHINE. . . .

. . . . . YOU MAKE *millions*

. . . OF ACCURATELY FORMED WIRE AND RIBBON METAL PARTS

The Baird automatic Four-Slide Machine produces an extremely wide variety of articles made of any commercial wire . . . round, half-round, square, or flat . . . at highest speeds. It takes coiled wire from a reel, straightens, feeds, and cuts off the required length . . . then forms and ejects the part produced. Eight sizes handle shorter wire lengths; three sizes take longer lengths to 32½".

By means of special attachments, the versatility of the machine is further extended to include the making of round wire and ribbon metal rings, secondary cut-offs, lettering, and other operations.

The detailed and complete story, with specifications, is told in our new Four-Slide Bulletin. If you require hundreds of thousands or millions of wire units to ½" dia., or flat ribbon metal products to 1½" wide . . . this is your profit-making machine. Send for bulletin.

3BA53

the BAIRD MACHINE COMPANY
STRATFORD • CONNECTICUT

AUTOMATIC MACHINE TOOLS • AUTOMATIC WIRE & RIBBON METAL FORMING MACHINES • AUTOMATIC PRESSES • TUMBLING BARRELS

Users tell the quality story

Precision Spring Corp. Depends On Pittsburgh Steel Oil Tempered Spring Wire For Uniformity

Nothing, absolutely nothing, can raise Cain in a spring shop like wire that does not come up to analysis specified. Take complicated coiling machines like the automatic Torrington or Sleeper-Hartley, feed them steel wire at high speed that is a fraction off grade and wham! . . . you're in serious trouble. Mr. A. H. Peterson, president of Precision Spring Corporation, Detroit, Michigan, prominent spring maker for the auto industry, puts it this way: "Pittsburgh Steel's Wire has good uniformity. That's why we use it. We can depend on this wire to work well in production, ton after ton. Every spring we make must meet the customer's specifications for length, diameter, load, and deflection."

It all adds up to this: Lack of uniformity in steel wire within its specifications for grade can knock the profits out of spring making. One failure in fifty springs can turn it into a loss item. Spring failure in an automobile can put a spring maker out of business.

The men who make and sell Pittsburgh Oil Tempered Spring Wire would like to serve you. They would like to have you depend on them as one of your regular sources of supply.

Call our district office in your area, or write a note to Department WW, Grant Building, Pittsburgh 30, Pa., for complete information about Pittsburgh Steel Wire.

Pittsburgh Wire

a product of **Pittsburgh Steel Company**

High-Performance DURPONS*

cost no more than conventional wire-drawing compounds

High-performance DURPONS are altogether superior wire-drawing compounds, developed after many years of Nopco research devoted to producing outstanding lubricants for the wet-drawing of nonferrous wire, rods, and tubes.

With Durpons, you gain two extremely important advantages, because incorporated into each are:

1. a buffer which tends to hold the pH of the drawing solution up . . . thus making the bath last longer, since the emulsion does not break;

2. a chelating (or sequestering) agent which ties up the metal ions so that they cannot react with soap to form insoluble metallic soaps. Flotation of metal particles is thus held to a minimum, and the bath kept clean.

You'll find Durpon compounds not only provide optimum lubrication, but retain their initial degree of performance for *twice as long* as conventional compounds. By using Durpons, you'll *reduce your drawing costs considerably,* because superior Nopco* products *cost you no more* than conventional wire-drawing lubricants.

We have immediately available:

DURPON — for intermediate gauge wire

DURPON L — for heavy wire, rods, and tubes

DURPON FW — for fine wire

If you draw nonferrous materials — such as copper and copper-coated rods and tubes — it will profit you to investigate. Fill out the coupon today. A technical bulletin and trial-size order will be sent you promptly.

*Reg. U. S. Pat. Off.

NOPCO
EVOLVED THRU RESEARCH

NOPCO

CHEMICAL COMPANY Harrison, N. J.

Branches: Boston • Chicago • Cedartown, Ga. • Richmond, Calif.

NOPCO CHEMICAL COMPANY, Harrison, New Jersey

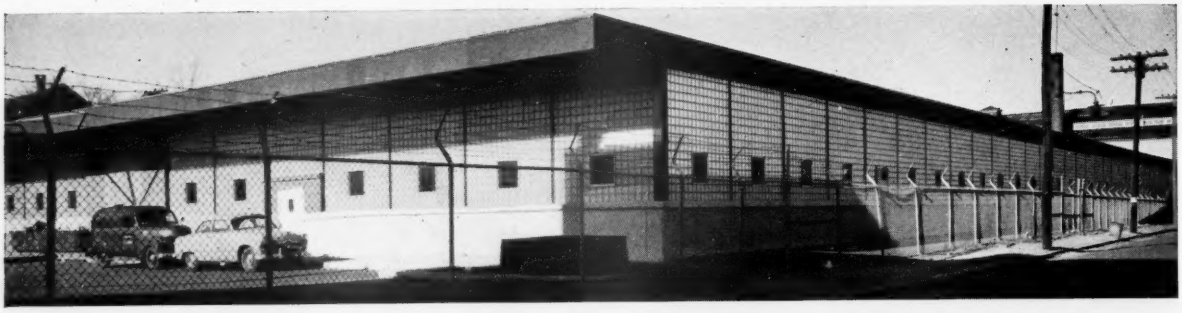
Gentlemen: Please send me a copy of your Bulletin giving information about Nopco DURPON Drawing Compounds.

Name..... Title.....

Company.....

Address.....

City..... Zone..... State.....



Good News for the Wire Industry

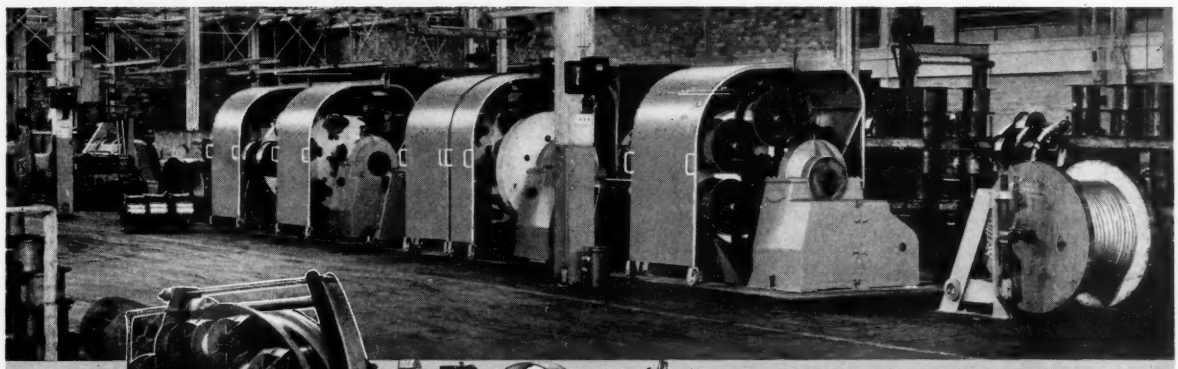
NEW ENGLAND BUTT COMPANY OPENS NEW PLANT . . .

It's a long time since 1842 when the first products of New England Butt Company were made. There have been a lot of changes since then — and a lot of improvements. The latest of these, our attractive glass walled factory, one of the most modern designed plants in New England, is good news to the Wire Industry. Here, the latest machines and manufacturing techniques combine to make Nebuttco Equipment, long known for high speed production of cables, strands, and insulation. Today, strong weldments take the place of ponderous castings in Nebuttco Equipment; accurate, smooth running machine-cut gears outmode the old cast gears; precision machined, interchangeable parts replace the hand-filed, hand-fitted components of yesterday. Now the Industry is served by Nebuttco wire making machinery produced in our modern plant and designed with a background of over a century's experience in making fine equipment.

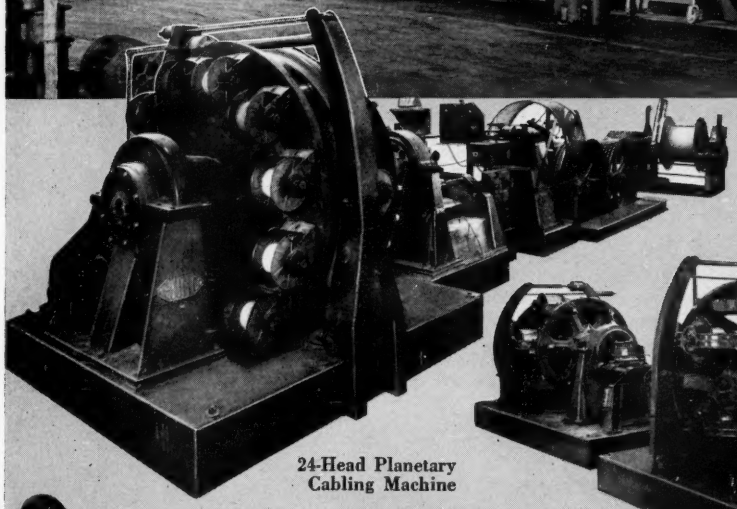
We will be happy to have you visit our new plant or will gladly send descriptive literature on any of our machines in which you are interested. New England Butt Company, 304 Pearl Street, Providence 7, R. I. James Day (Machinery) Ltd., 28 Maddox Street, London W1, England.

A corner in the Machine Department in the new plant of New England Butt Company

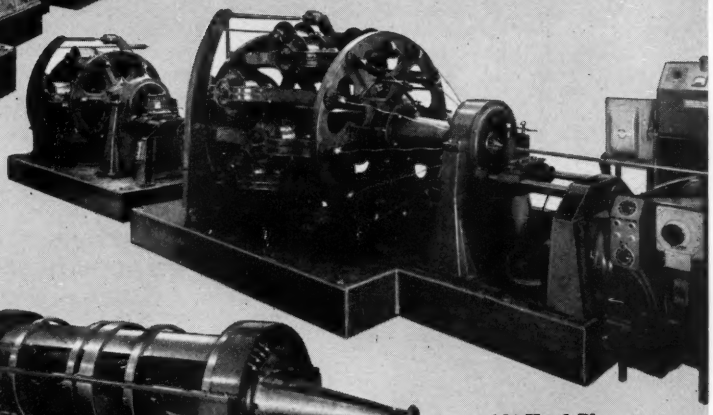
NEBUTTCO



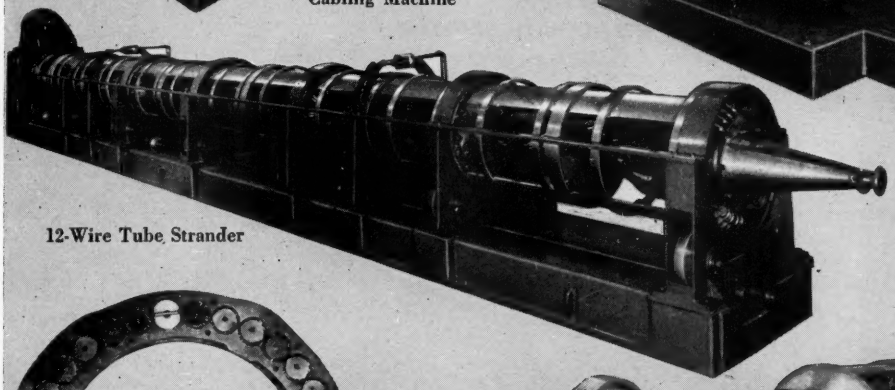
54-Spool Fixed Strander



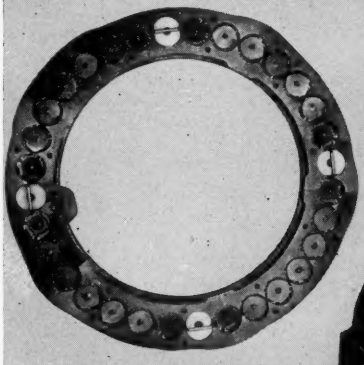
24-Head Planetary
Cabling Machine



6-12-Head Planetary
Cabling Machine



12-Wire Tube Strander



Locating Plugs for Cable
Braider Top Plate

13-Reel Strander

NEBUTT CO.

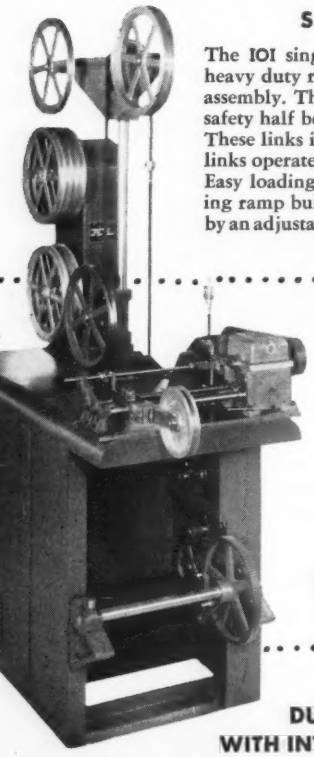
MACHINERY FOR HIGH SPEED PRODUCTION

Braiders • Cablers • Take-ups
Bunchers • Stranders
Taping Machines

STANDARD LET-OFF and TAKE-UP STANDS for the WIRE INDUSTRY

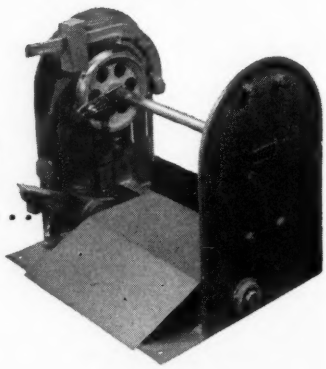
IOI ENGINEERING VERSATILITY

Speed, control and change of pace are basic factors in IOI design of continuous materials processing equipment. Widely experienced in the application of these factors to continuous systems, IOI's engineers have embodied technical skill, sound engineering principles and ingenuity in all IOI equipment, to develop standard units that are flexible enough to meet a variety of applications with simple variations.



SINGLE REEL LET-OFF STAND

The IOI single supply reel Let-Off stand consists of a rigid heavy duty reel mounting equipped with reel shaft and brake assembly. This shaft assembly, holding the reel, is carried on safety half bearings mounted on heavy vertically guided links. These links in turn are raised and lowered by power amplifier links operated by a latching foot pedal outside the stand frame. Easy loading and unloading are assured by a steel plate loading ramp built into the stand. Brake shoe tension is controlled by an adjustable counterweighted arm and brake shoe assembly.

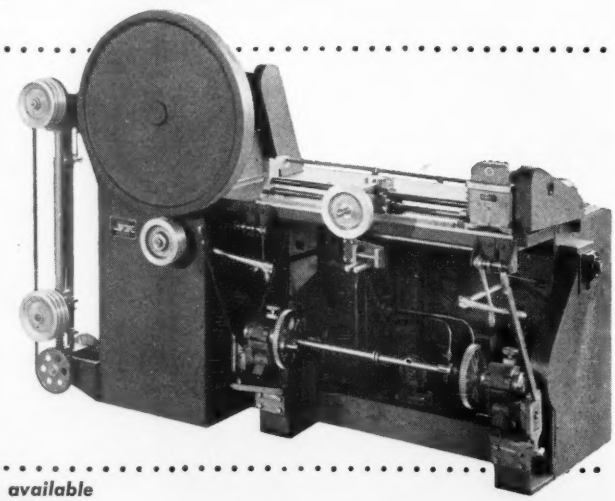


SINGLE REEL TAKE-UP STAND WITH CAPSTAN

Integrating reels, capstans, power source with hydraulic or electronic controls into one unit, IOI's variable-speed, constant-tension Take-Up machine is unexcellled for smooth, stepless winding of continuous and semi-continuous materials after processing operations. It has everything: winding speeds of wire and other materials are 3 to 5 times faster than previously; control in handling materials requiring tight wrap or loose wrap with equal facility; change of pace which continuously regulates the speed of Take-Up reels by automatic synchronization to maintain tension regardless of diameter change.

DUAL REEL TAKE-UP WITH INTEGRAL CAPSTAN

This combination capstan and continuous Take-Up system was especially designed for continuous extrusion take-up of synthetic or rubber coated wires, cords or cables. By manual means the wire or strand is shifted from the full reel to the empty one without interrupting the winding process. All functions of the operation are combined in one compact machine. An ingenious IOI reel mounting features a demountable shaft and bearing housing assembly carried by a heavy bearing mounting on a lever-operated tilting base. Lever operation of the housing raises reel into operating position easily. Reel flanges are set on the floor. Flange edges of the reel are subject to little or no distortion or bending, prolonging the reel life and facilitating level winding.



These standard units (with or without drives) are available now, ready for prompt shipment. For complete information write:

INDUSTRIAL IOI ENGINEERING VERSATILITY **OVENS, INC.**

13825 TRISKETT ROAD CLEVELAND 11, OHIO

NATIONAL

WIRE

(COLD ROLLED)

in Coils or Straight Lengths

COMPLETE METALLURGICAL SERVICE

Manufacturers of

SPRING WASHERS	RETAINING RINGS
ROUND EDGE FLAT WIRE	KEYSTONE SHAPED WIRE
SQUARE EDGE FLAT WIRE	SPECIAL SHAPED WIRE

Shaped Wire in Coils or Straight Lengths, Ferrous or Non-Ferrous.

LARGE OR SMALL QUANTITIES

Manufactured by

THE NATIONAL LOCK WASHER COMPANY

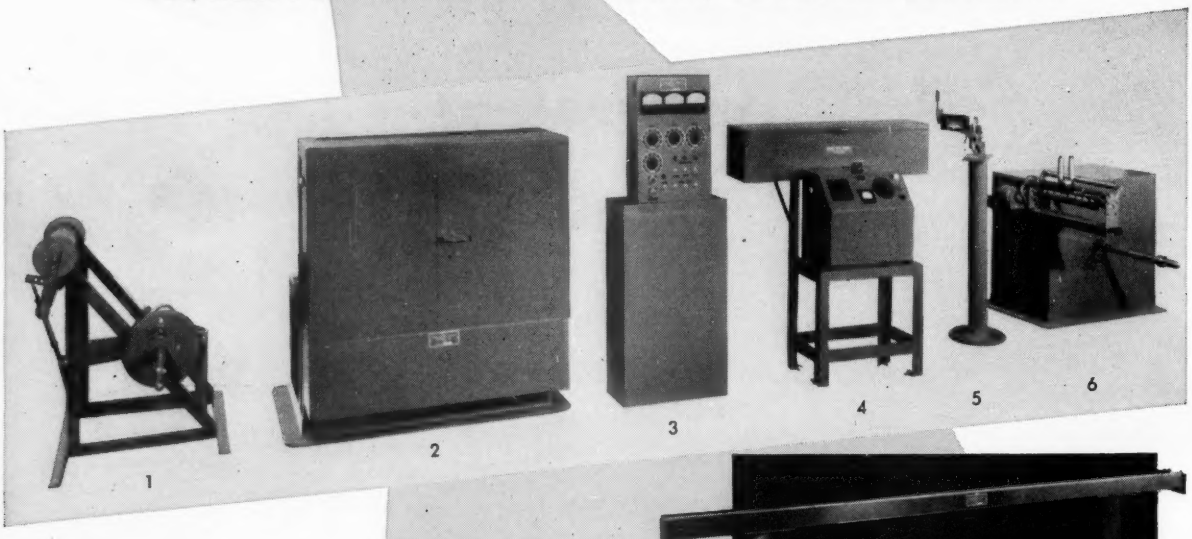
PRECISION SHAPED WIRE DIVISION

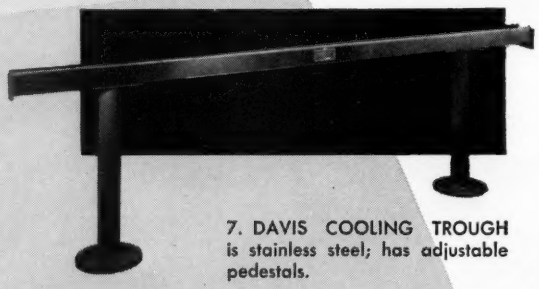
NEWARK 5, N. J. MILWAUKEE 2, WIS. U.S.A.

for faster, more uniform wire production,

USE DAVIS EQUIPMENT WITH YOUR EXTRUDER.

Teamwork in machinery is just as important as teamwork in manpower. All Davis-engineered wire-covering equipment is designed to function hand-in-hand with your extruder . . . from the Pay-off right thru to the Take-Up . . . to co-ordinate your insulating operations into one smooth production line that SPEEDS OUTPUT, makes a better, MORE UNIFORM PRODUCT, and BOOSTS YOUR PROFITS!





7. DAVIS COOLING TROUGH is stainless steel; has adjustable pedestals.

1. DAVIS PAY-OFF is simply yet ruggedly built for wide range of reel sizes. Constructed for long, dependable service, its automatic control prevents wire overtravel . . . stops when wind-up stops!

2. DAVIS CAPSTAN design improvements give you lower cost. Use of welded steel also effects weight-saving. Improvements include aluminum alloy wheel (15, 30 or 36"), stainless steel cooling tank and enclosure. Single or dual for heavy pulling operations. In speeds to match your needs.

3. DAVIS CONTROL PANEL is electronically operated; enables presetting capstan speeds and wind-up tension accurately over a wide range. Controls quality and uniformity of wire; saves time and materials.

4. DAVIS CV TYPE SPARK TESTER tests insulations on continuous vulcanizing or plastic extruding machines. Sensitive, it spark-tests wire up to 1200 feet per minute. It signals and counts insulation faults. Test volts 3,000 to 15,000; 6,000 to 30,000 on standard units.

5. DAVIS COUNTER, with totalizer, is simple to set and guaranteed accurate. Self-contained; easily moved. For wire and cable sizes .010 to 1½".

6. DAVIS TAKE-UP provides speed tension and control with a minimum of operator supervision. It has its own individual drive, and adjustable traverse for various wire and cable sizes and reel widths.

All Davis equipment is assembled, tested, and delivered ready for use; is ably engineered, fabricated of finest materials by wire mill craftsmen for long life and thorough satisfaction. Your inquiries are invited. Write for literature.

Davis ELECTRIC CO.
WALLINGFORD, CONN., U.S.A.

HARNESS TESTERS ★ PAY-OFFS ★ TRAVERSES

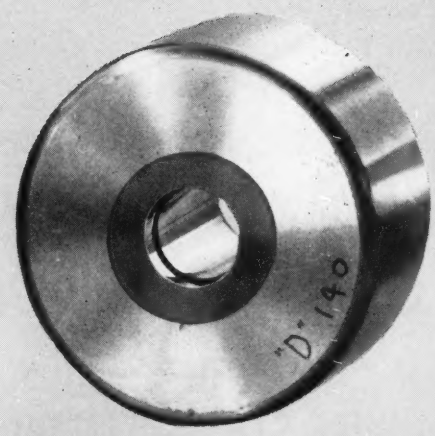
SPARK TESTERS ★ SPOOLERS ★ TAKE-UPS ★ CAPSTANS

Correspondents throughout the world

Foreign Sales Representatives: OMNI PRODUCTS CORP. 460—4th Avenue, New York 16, New York

DAVIS WIRE & CABLE EQUIPMENT

The Hyprez formula for the right finish faster



HYPREZ

High Precision DIAMOND COMPOUNDS

The exclusive vehicle engineered for highest performance, together with scientifically graded pure diamond particles, produces superior finishes faster. A complete range of grades from finest to coarsest is available.

Ask for a Free Demonstration, or Technical Bulletin No. W-7-53

HYPREZ DIVISION

ENGIS EQUIPMENT COMPANY, 431 SOUTH DEARBORN ST., **CHICAGO 5, ILL.**

NOW! INFINITE FEED CHANGES AND CONTROL --- INSTANTLY -- ACCURATELY -- ECONOMICALLY!

New!

VARIABLE SPEED DRIVE

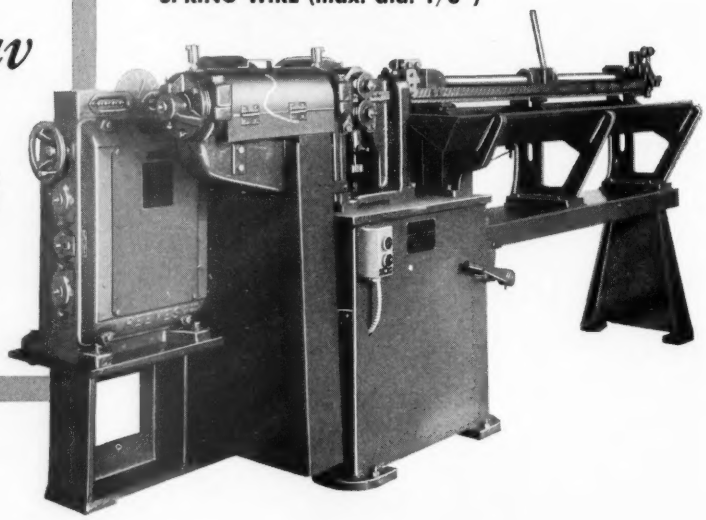
SHUSTER *1av*

Automatic

WIRE STRAIGHTENING & CUTTING MACHINE

BASIC WIRE (3/32" to 1/4")

SPRING WIRE (max. dia. 1/8")



- **Geared to feed any speed from 50 to 200 feet per minute.**
- **Capacity 3/32" to ¼" dia. basic wire; to ⅛" Spring wire.**
- **Immediate selection of the r.p.m. best suited for the work and the needs of the operator.**
- **One machine to straighten and cut wire of different sizes, different alloys, different tempers.**
- **Once set, constant speed is maintained in spite of possible load variations.**
- **On-the-job-adjustment of speed to compensate for any variations in wire coil. Maximum productivity.**
- **Simple, economical operation. Trouble-free maintenance.**

WRITE FOR

BULLETIN No. 53

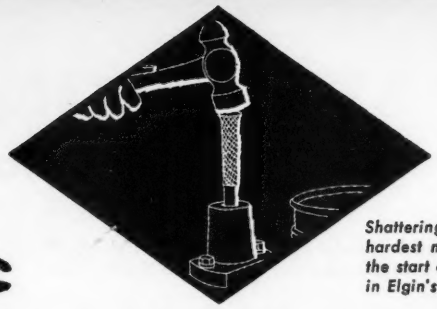
METTLER MACHINE TOOL, INC., New Haven, Conn.

Manufacturers of SHUSTER (Est. 1866) Automatic Wire Straightening and Cutting Machines.

NEW YORK OFFICE: Eleven Broadway, Tel: WHitehall 4-5480

Representatives in all principal cities and in foreign countries.

How a better abrasive begins



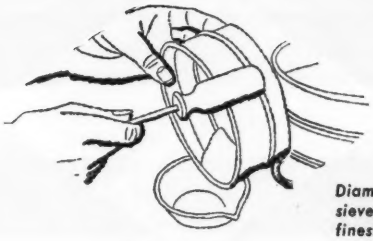
Shattering pure diamond bort, hardest material known, at the start of the crushing process in Elgin's laboratories.

Here is how all Elgin Diamond begins . . . in an $8,000 handful of pure diamond bort. For more than 10 years, every step of production, from bort to finished DYMO compound has been completely performed in the Elgin Diamond laboratories, under the control of Elgin technicians . . . a unique production arrangement permitting maintenance of absolutely rigid quality standards.

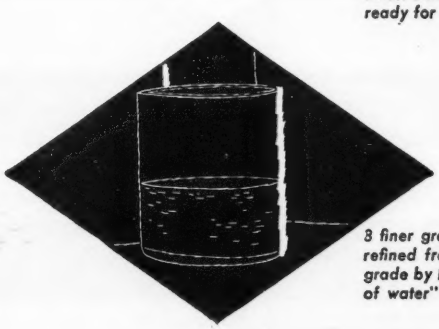
Results in hundreds of industrial applications have proved that DYMO finishing is the sure way to reduce costs and produce a better finish every time . . . in less time! Write for specific application data today.

Every day, more and more leading producers find that it's best to FINISH WITH DIAMOND . . . ELGIN DIAMOND.

Ask for a free demonstration!



Diamond powder is mechanically sieved into ten grades. The finest sieve grade shown here is ready for further processing.

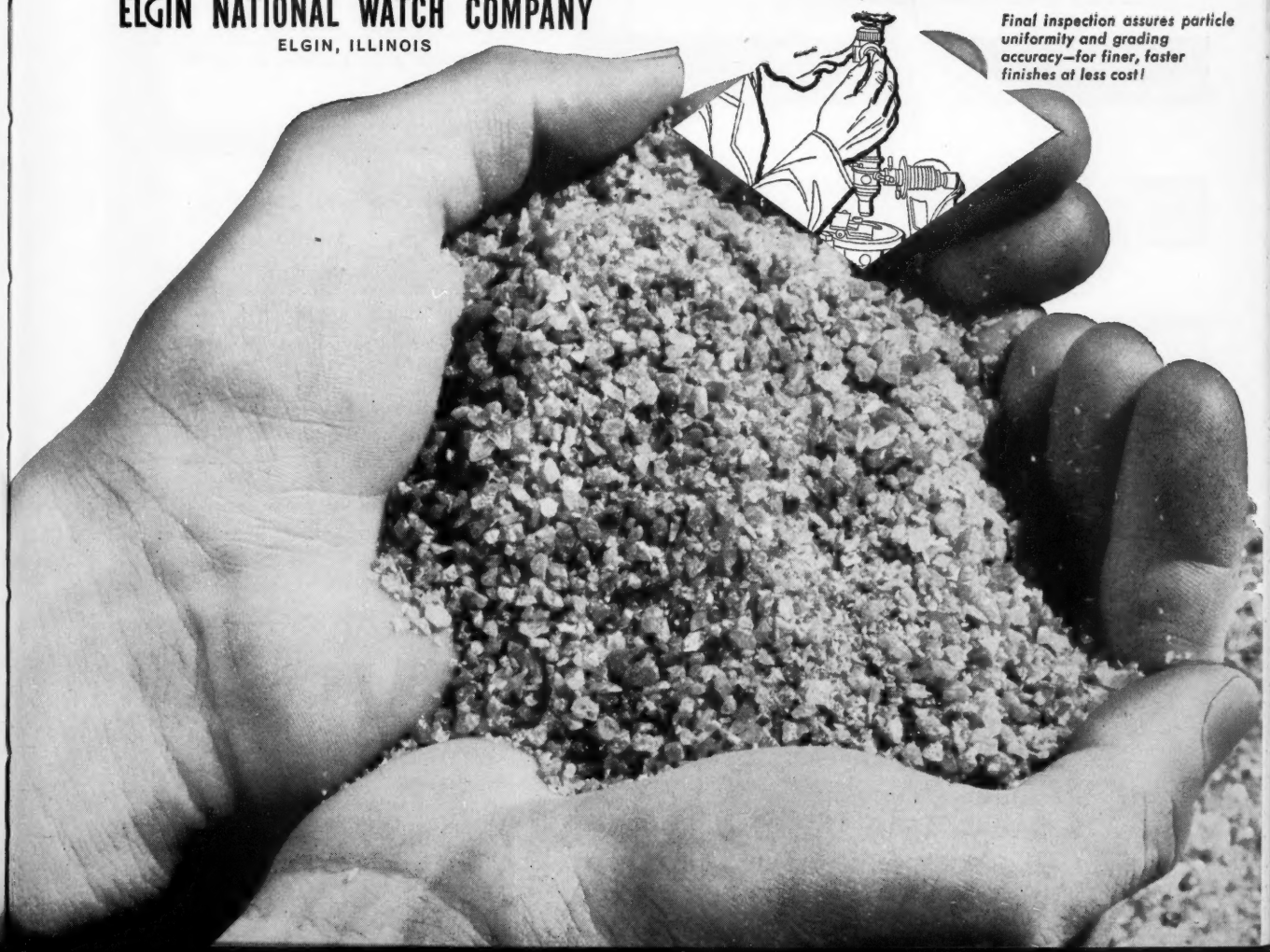


8 finer grades are further refined from the finest sieve grade by Elgin's "layers of water" process.

ABRASIVES DIVISION

ELGIN NATIONAL WATCH COMPANY

ELGIN, ILLINOIS



Final inspection assures particle uniformity and grading accuracy—for finer, faster finishes at less cost!

STEELSKIN Lubricants
—and how to use them...

(No. 2 of a Series)

This is second in a series of advertisements cataloging the complete line of Steelskin Lubricants. Keep this for handy reference.

PRODUCT	DESCRIPTION	SHIPPING INFORMATION	USES
#76	Metallic Soap Powder	Fiber Drums 275# Net	For drawing rod or wire coated with lime or STEELSKIN W-Coating Compound. End uses include wire for springs, nails, rope, galvanizing, tire bead, poultry netting, screen cloth, etc.
GOLDEN Redskin	Blended Crystals	Fiber Drums 400# Net	Production of straw-colored and liquor-finished wire. Eliminates the waste of the metallic-tin process.
X-2	Compounded Soda-Soap Powder	Fiber Drums 275# Net	A general-purpose dry powder for high- and low-carbon rod and wire. More readily cleaned after drawing and annealing. For welding wire and coat-hanger wire (on continuous machines) using a light lime.
560-M	Paste Compound	Steel Drums 480# Net	A water-emulsifiable compound resistant to lime, used to produce a bright finish on bar stock prior to straightening and cutting.
X-Bright Grease	Paste Compound	Steel Drums 480# Net	A one-hole lubricant for producing extra-clean extra-bright wire.
Z-Bright Grease	Paste Compound	Steel Drums 480# Net	A multiple hole lubricant for producing bright grease-drawn wire.
DS-8-B	Compounded Soap Powder	Fiber Drums 300# Net	For use on descaled rod to produce a clean finish for electric-welded fabric wire, welding wire, etc.
PF Bars	Waxy Solid	Fiber Drums 275# Net	For use on the take-up frames of patenting units to prevent binding and facilitate bundle removal.

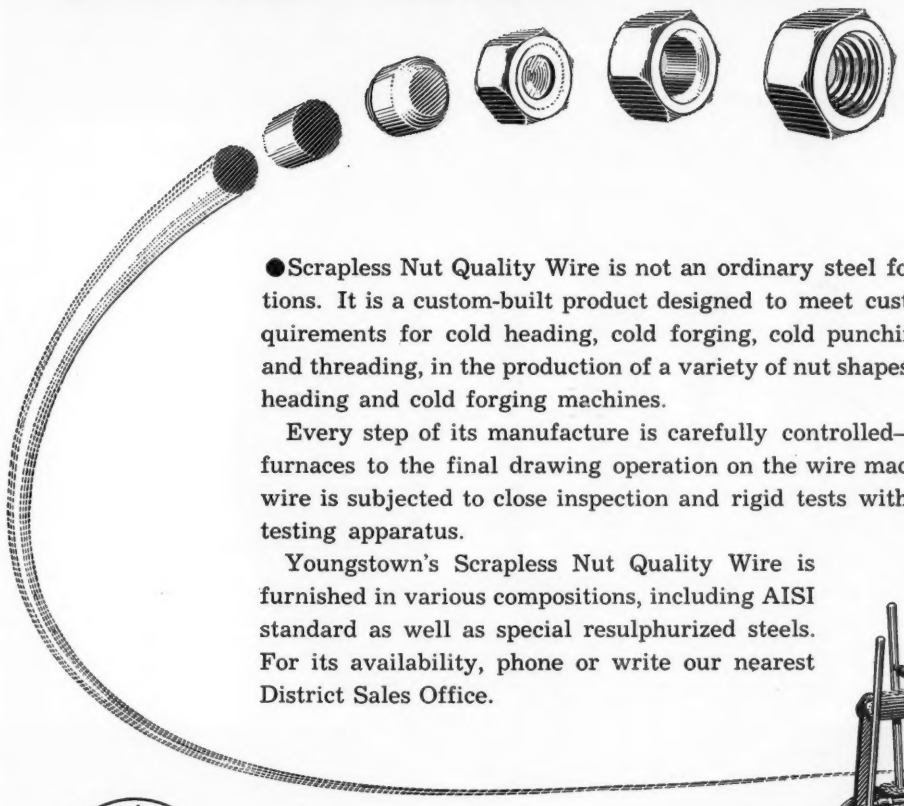
Steelskin LUBRICANTS

R. H. MILLER
Company, Inc., Homer 1, N. Y.

SOAPS AND COMPOUNDS FOR WIRE DRAWING, TUBE DRAWING, DEEP DRAWING AND STAMPING.

Custom built to customers' requirements...

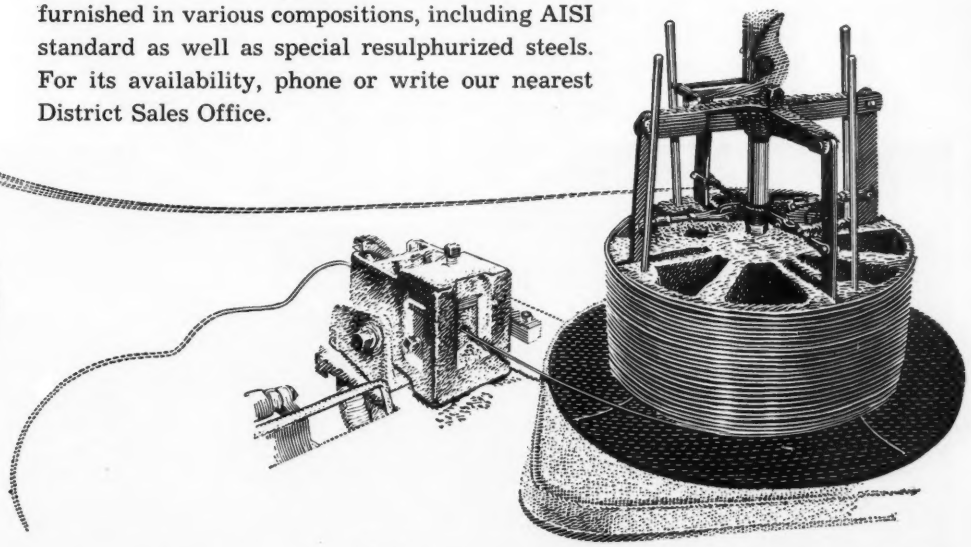
YOUNGSTOWN SCRAPLESS NUT WIRE



●Scrapless Nut Quality Wire is not an ordinary steel for common applications. It is a custom-built product designed to meet customers' specific requirements for cold heading, cold forging, cold punching, cold expanding and threading, in the production of a variety of nut shapes on continuous cold heading and cold forging machines.

Every step of its manufacture is carefully controlled—from the melting furnaces to the final drawing operation on the wire machines. Each coil of wire is subjected to close inspection and rigid tests with modern electrical testing apparatus.

Youngstown's Scrapless Nut Quality Wire is furnished in various compositions, including AISI standard as well as special resulphurized steels. For its availability, phone or write our nearest District Sales Office.



QUALITY YOUNGSTOWN SERVICE

Youngstown SCRAPLESS NUT QUALITY WIRE

THE YOUNGSTOWN SHEET AND TUBE COMPANY *Manufacturers of Carbon, Alloy and Yoloy Steel*

General Offices: Youngstown, Ohio - Export Office: 500 Fifth Avenue, New York 36, N. Y.

PIPE AND TUBULAR PRODUCTS - CONDUIT - BARS - RODS - COLD FINISHED CARBON AND ALLOY BARS - SHEETS - PLATES - WIRE - ELECTROLYTIC TIN PLATE - COKE TIN PLATE - RAILROAD TRACK SPIKES

For the FINEST Dies...

Specify

DIES... TOOLS... WEAR PARTS... BLANKS...

TELEPHONES: FACTORY and BRANCHES

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IN CANADA: (TOOLS) CARBIDE TOOL CO. W. Toronto 3, Ont. (DIES) VASCAPE TOOL & DIE CO. Hamilton, Ont.

The Wire Outlook

What will the truce in Korea mean to us?

Apart from the human factors and the sense of relief on the part of those whose boys are in or would be going to Korea, it will pose some new business problems.

Business will soften, but there will be no slump, since defense spending will continue substantially at the present rate. The Administration wants business to slow up somewhat to check the inflationary trend. There will be production readjustments as the emphasis on the types of war materiel is altered by a cessation of the shooting war.

Tax cuts, to have been delayed, will be pushed forward on the original schedule. Unemployment will rise, but not dangerously, and this is felt to be desirable, because those who are employed are more likely to work better and be less demanding on further wage increases. Important, too, is that a peace of sorts will greatly strengthen Mr. Eisenhower with the Congress and further his efforts toward needed reforms. Competition will increase and serve as a regulator of business.

For a while, at least, the tight credit situation will be maintained, but should there be too much slackening of business, it will be eased. The boom may be said to be at its peak and for some weeks will carry along on its momentum.

Foreign aid will face tougher going in Congress. It has been found that our endless giving has not bought friends. Probably the principle of extending aid is good, but the manner in which it has been done, with almost wanton lavishness, has been very bad indeed. We are among those who believe that aid can be cut materially and should be eliminated promptly where there is no evidence of appreciation and cooperation. The Truman-Acheson foreign policy, still in effect, needs a drastic overhauling.

Expenditures for construction are running at an all-time high this year and may reach 33 billions in spite of a decline in industrial building. Steel production is running over its rated capacity, with the demand for it showing little sign of tapering off; capacity for finished steel products is in excess of ingot production. The appliance picture continues bright. The first half of 1953 has shown the highest rate of car production in history. All these factors, and others, are promoting a healthy demand for wire of every kind.

Nickel, one of our tight metals, may be decontrolled on January first, if all goes well, and nickel-bearing steels may have curbs removed even earlier. Large quantities, however, will still be set aside for military purposes. With aluminum capacity still on the way up and monthly production at record levels, the outlook for more of this metal is brightening constantly. The copper picture looks good—production is up and the supply improving. The trend on prices will be downward, if anything. Lead and zinc supplies are abundant, with production having been slowed by the low prices.

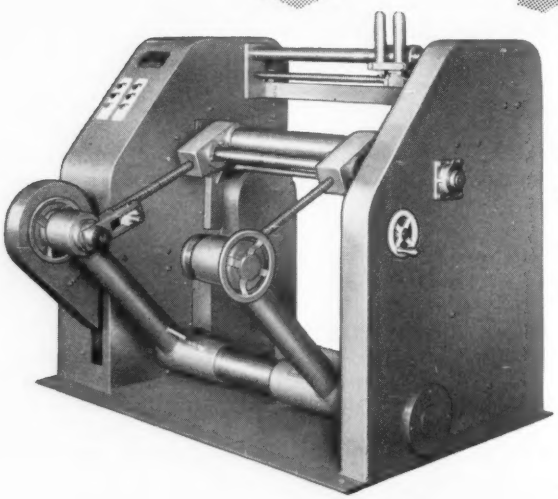
The demand for manufacturers' wire is steady, although plain galvanized wire is a bit slow. Bed spring, upholstery and music wire demand is strong. High carbon wire, due to automotive needs, is booked well into the third quarter. Most grades of cold heading wire are selling well and inventories of cold headers are being kept in fair balance. In the fastener field backlogs are off, but only to a degree that returns the manufacturers to more normal ratios of orders to production. Wire prices generally had risen earlier due principally to increases of the prices on numerous extras, but the new wage agreements have now increased basic prices by $4.00 to $120.00 a ton.

The developments of the next few months will make history. The odds are that they will be favorable.

—from the Editor's Desk

SHAFTLESS TAKE-UP

Eliminates the use of Reel Shafts



OUTSTANDING FEATURES

- Motor-driven reel lift with automatic stop with reel loading position.
- Handwheel adjustment with indicator for reel width adjustment.
- Traverse mechanism infinitely adjustable for traverse, lay and starting position.
- Hardened steel guide rolls adjustable to cable diameter.

Machine made in the following reel capacities.

Reel Dia. - - - - - - 24" Min. to 48" Max.
24" Min. to 50" Max.
30" Min. to 60" Max.
36" Min. to 72" Max.
36" Min. to 78" Max.
42" Min. to 84" Max.

Reel Width - - - - - - - - 48" Max.

Reel Weight - - - - 16,000 lbs. Max.

DESCRIPTION

The frame is of heavy fabricated steel construction of sufficient rigidity for the specified load and is mounted on a steel bed plate. The reel lift arms are of heavy steel tubular construction and are fulcrumed on a hollow steel sleeve. The reel pintles are mounted on anti-friction bearings and are moved into engagement with the reel arbor holes by means of a handwheel. Heavy roller-chain drive is fully guarded.

Reels are lifted by means of motor-driven screws. The reel raising and lowering motor is automatically controlled to lower to the reel diameter being used. Two sets of reel pintles are furnished to fit reel arbor holes as specified.

The take-up drive is available in various combinations to meet customer specifications. These may include:

1. Infinitely-variable drive, cable tension controlled.
2. Straight motor drive.
3. Adjustable constant-reel-shaft-speed.
4. External drive.

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See page 712 for a complete listing of JLE Products for the Insulated and Bare Wire Industry.

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Methods-Time Measurement

by R. L. Bugbee
Leetham-Simpson, Ltd.
Montreal, Canada

In this interesting paper, delivered at the Montreal Regional Meeting of The Wire Association on May 8, 1953, the author discusses the principles of MTM and their relation to efficient production studies that will assign time values to the motions of production work.

It is indeed a privilege to be here at this Montreal Regional Meeting of The Wire Association to meet and discuss with you the various areas in which MTM may profitably be applied in your industry.

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I would like to stress the point of discussing these aspects with you—as I intend to limit my talk so as to only briefly touch upon the principles of application of MTM. Thus I hope to allow you to relate its possible uses to the various operations in your own plants in order to elicit a beneficial discussion period for all concerned.

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No doubt most of you know that MTM — Methods-Time Measurement—is a recent industrial engineering development which analyzes manual work into the motions required to perform that work, and to each motion, assigns a pre-determined time value.

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Unfortunately, this type of statement leaves many of us wondering just what are "basic motions" and "pre-determined time standards."

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On the other hand, to gain an understanding and knowledge of a subject, one cannot simply look at the definition, one must know something of its history and development.

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Therefore, I would like to first briefly touch on the background of MTM in order that we might more fully appreciate its present status.

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We all know that our standard of living depends upon the number of goods and services that we, as a nation, can produce. We know, also, that we can only divide what we produce.

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In the past, we have tried to raise our production of goods and services—to raise our standard of living, that is — by introducing more and better machines. Now, however, we are finding that machines are not the whole answer, because the machines still have to be operated by men and women.

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We cannot invent better men and women. We have to carry on with the people that we have—both ourselves and the people around us.

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More and more we have come to see that we will not achieve our potentially highest standard of living by improving our machines alone. We must also work to improve our human relations in industry.

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The more progressive managements and engineers have been aware of this fact for some time, and much has been written on the subject. As a part of the work to better understand what "makes people tick" many surveys have been conducted to determine what is important to the worker for job satisfaction. We know that—

Job security
Fair treatment by supervisors and the company
Appreciation of effort
Attention given to complaints
Opportunity to make suggestions

as well as others, are high on such survey lists.

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We also know that there is one item that humans resent and frequently resist—change.

Yes, you and I resist change—when it affects us personally—just as do the factory and office workers we must deal with in our daily work.

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Let me illustrate the point. We have all heard of that internal foreign country in the United States called Texas. If we were told today to wear Texas high-heel boots to work starting next week, I know most of us would rebel at the thought and many arguments might arise—BUT, if the Texans were told that they could not wear their traditional footwear, there would probably be a mild revolution.

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In the industrial engineering field our work has largely been a system of trial and error as we went through a series of changes to arrive at what we then called the one best method available at the time.

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Each and every time we suggested a change, we were going against one of our basic human reactions—our resistance to change.

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As a result, the industrial engineering field has been referred to as Methods Corrections Work, rather than as Methods Engineering, as we would prefer to refer to it.

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Our work in the industrial engineering field is to change methods, procedures, workplace layouts, etc. and to then install our new ideas. In many cases, because of a lack of a specific measuring device, we attempted to use our previous techniques to the limits of their capabilities in order to determine what would be the effect of our change. In the industrial engineering field, we did not have Ohm's Law as did the electrical engineer to guide us to specific results, nor did we have specific tested knowledge as the chemical engineers or physicists possess for predicting results with any degree of accuracy.

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It was this lack of an industrial engineering technique to allow us to properly engineer a job ahead of the start of production, that led to the original investigation in, what we now know as the MTM Procedure.

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Harold B. Maynard and G. J. Stegmerten started with Jack Schwab in approximately 1940 to see what could be done to arrive at basic motion times for a Methods Time Formula. This original work started in the main plant of Westinghouse in East Pittsburgh, Pennsylvania. To make a long, and at times a somewhat disheartening, story short, after analyzing several thousand feet of motion picture film of industrial operations, frame by frame, and after changing the original approach, the procedure we now know as MTM was evolved.

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In about 1945-46 the procedure was "guinea-pigged" in the first few plants to prove their findings. After amazing success in these plants having widely varying operations, the founders felt their beliefs in their new technique were validated.

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It was not until after these first installations had proved successful that the book "Methods-Time Measurement"* was published in 1948 and the procedure made available to the public.

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Today, there is an MTM Association for Standards and Research which serves industrial members and member management consultants who provide training in, or apply the procedure.

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Today, we find MTM in use in approximately 1000 companies throughout the free world, in such countries as: the United States, Canada, England, Norway, Sweden, Denmark, France, Belgium, Holland, Switzerland and Australia. Companies using the procedure range from jobbing shops to large mass production plants, with products varying from candy to large single steel assemblies for paper machines too large to be shipped by rail without dismantling.

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In the past six years, there has been a great development in the areas of application and use of the procedure.

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Today, the use and application has far exceeded the fond expectations of its founders. Today, we are all working together to continue research in new areas, and to further increase our knowledge of what has been termed "the most important Industrial Engineering development of this century".

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However, obviously any such wide spreading procedure has aroused questions and has been the subject of many discussions, some of them no doubt, heated.

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Well, what are some of these advantages which the procedure affords?

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First of all, let me say in all honesty and sincerity, the procedure is not a cure-all. It will not automatically increase production or upon the completion of a training course, provide you with superproduction men.

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However, in fairness to the outstanding results achieved to date by the industrial users of the procedure, I should say that after proper training and when properly applied, the following are some of the benefits which can be expected:—

1. **It is accurate and consistent. This accuracy is especially valuable in short cycle work. The benefits of consistent standards between jobs, departments, or plants, need not be elaborated upon.**
2. **It is quick, easy and economical to apply.**
3. **For many companies this new tool makes new areas to study. This is particularly true in jobbing plants or maintenance activities, stores keeping and the like.**
4. **It is an additional tool for the industrial engineer, which when properly applied permits him to do a real engineering job ahead of the start of production. Thus, many costly changes are eliminated and human relations improved.**

***"Methods-Time Measurement"—Maynard, Stegmerten & Schwab; McGraw-Hill, New York, N. Y. 1948.**

5. **Rating is not required of the operator's performance during a study.**
6. **Standards on the manual content of most jobs can be established without the use of a mechanical timing device. While there is nothing wrong with a stopwatch—and it will be continued to be used on process time —we must recognize the present inward or open resentment of people whenever they are timed.**
7. **An MTM analysis provides a detailed methods description which is invaluable for control and cost purposes and for use in operator training.**
8. **Training in the procedure generally develops a new concept of methods consciousness and cost awareness and of how people work.**
9. **Proper use of the procedure in analyzing a job frequently leads to methods improvements because of the type of analysis required in the application of the procedure.**

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The fairness of the procedure and its acceptance by workers has done much to decrease industrial grievances. Discussions over the standard or the method to be used can be discussed objectively. Although this is a very thought-provoking statement to those of you who have not experienced this type of industrial "discussion" the best I can do is to refer you to those who have been using the procedure over a period of time.

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These are the results of application found by many MTM users.

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Let us now pass on to a discussion of the areas of application of the procedure especially as they might apply to the wire industry, leaving questions which will no doubt arise, for our discussion period.

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MTM is generally thought of as applying to the following areas:—

1. **Establishing Production Standards**
2. **Development of Standard data and Time Formula**
3. **Improving methods**
4. **Estimating**
5. **Operator training**
6. **Tool and Fixture designing**
7. **Material handling**
8. **Balancing production lines before production is started, etc.**

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However, there are very important advantages to be gained in the application of the procedure to:

a. **Maintenance activities**
b. **Clerical work measurement**
c. **Use as a basis of Standard Costs**
d. **Labor control.**

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Recently, I had the opportunity of visiting several member firms of your Association. I would like to thank each of them for their time and courtesy and for the opportunity provided for gaining some insight into your industry.

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As a result, I feel that I am in a little better position to understand your probable comments that "Our business is different." Actually, I look forward to such comments and have found it disappointing at times when such a statement was not forthcoming on some of my engineering assignments.

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Yes, to be true, in your industry many of your basic operations are machine or process controlled. The extent of machine controlled operations will vary widely between your companies and between plants. Therefore, my following remarks will probably not apply equally to each of you. However, if you will bear with me I hope that I can provide you with the results of my short survey.

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If your plant is not on measured standards and does not have incentive or piece rate system, the advantages of MTM to your organization might be greatest in the field of establishing production standards and in developing formula and standard data and costs for the various operations. In other plants where standards are established and piece work or some form of incentive is installed, the advantages of MTM may be greatest in the field of methods improvement, or operator training, or estimating, and in developing a methods and cost conscious organization. So, to state the biggest advantage of MTM, one must question what are the conditions existing in the organization about which we are contemplating installing or using MTM.

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Let us for a moment discuss a situation that each of you have to some degree—that of a relatively high process controlled operation.

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In such cases, the usual feeling is that standards are based largely on machine speeds and capacity—or even on past production records. Now, this may be fine in some cases, but may I ask one or two questions on such a procedure of establishing a standard.

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First, how do you know that the production you got was a fair day's work without measured standards?

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Second, how did you evaluate the load-unload downtime portion of the cycle?

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I would like to point out that in some plants I visited, I saw certain machines in production where I would question the added benefits of using MTM. On others, the advantages were obvious.

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Let me pose a question.

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In some cases we might find two machines operating at 75% and 93% efficiency.

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For purposes of illustration, if the first, that is the machine operating at 75%, has an hourly overhead worth of $6.00 an hour, the overhead cost per minute would be 10¢. If we were able to analyze the handling methods, and reduce the load cycle and thru other means, raise the machine efficiency 10%, we would only save ourselves 10% of 10¢ per minute, or 1¢ per minute.

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On the other hand, our second machine, which was running at 93% efficiency, might appear to some to be doing fine and not be worth the cost of additional study. However, let us look further at the economics of the situation. If this second machine had an overhead worth of $90.00 per hour, as some of the larger machines I saw must have, we would only have to in-

crease the machine's operating efficiency by 1% thru saving on the handling and change-over time in order to realize a gain of 1½¢ a minute.

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Thus, I wish to stress a point most of you are well aware of, that the present machine's performance is not the only criteria for determining whether or not to make a further detailed study.

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MTM, with its accuracy, and the type of thinking it fosters, can in many cases, prove valuable to study in detail all aspects of just how reels are put into and removed from the machine, and how other periodic work such as splicing or reel changes, are made. Because the increase of only one per cent gain in the operating time of the machine may mean substantial returns.

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We frequently find a situation where an operation is, let us say 75% machine controlled and 25% manual. As such, it may not appear economical for study. But what are the conditions if we can study the job—assign two or three or even four machines to the operator. Then we have an opportunity of working to reduce the manual content of an operator who is loaded 50, 75 or 100% of the time. As such it then becomes a profitable venture.

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I am sorry that we all cannot gather round a stranding or other type machine to see just how we might go through such an MTM analysis, but I also realize you are not interested in such details.

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Therefore, inasmuch as some of you may duplicate the facilities of that competitor sitting on your right or in front of you, I will not try to give away any trade secrets or to attempt to pass on any outstanding cost saving ideas.

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Instead, let me just briefly mention other possible areas which I feel lend themselves to MTM application in your type of plants, before opening our discussion period.

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Accurate standard costs based upon sound measured standards are doing much today to improve the quality of estimating of many companies and thus improve their competitive position. MTM when properly applied, with its resulting accuracy and consistency, has been most successful in this field.

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With MTM it is possible to accurately establish the work load of an individual on a machine or per small segment of a machine. As such it is then possible to accurately project such results into man and machine charts to determine the number of machines or stations an operator should tend. This is especially true for your braiding machines or other types of equipment where constant operator attention is not required.

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Frequently maintenance activities lend themselves to study using the MTM procedure. Many of you have large forces of such personnel which would no doubt be amenable to coverage under a preventive maintenance program.

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Packing and shipping departments are also well adapted to savings using the procedure, as is inspection work.

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Here, because of the basic approach of MTM to establish standards based upon the required work content in the job, accurate standards are possible which frequently could not be achieved with conventional time study.

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Certainly many of you have plants or sections of your plants which are not subject to major changes or improvements unless the machines themselves are modified. However, there are probably also many areas which can be profitably subjected to the detailed analysis made when the MTM procedure is used to study an operation.

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Over the years most of you have not questioned buying your maintenance man an additional tool, provided it could be effectively used at times.

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The question of the advantages and whether or not to use MTM is a striking parallel. Your methods and time study men are your "maintenance men" for production methods, costs, and procedures. Therefore, from my observations in each plant I have visited, I feel that your methods or time study men can profitably use this new industrial engineering tool to both their and your advantage.

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It is difficult to assess the monetary return from the type of thinking which the training instills. It is also hard to evaluate in terms of cold dollars and cents, the value of the ability, when called upon, to make a successful detailed analysis resulting from proper application of the procedure.

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Frequently, even one successful application per year will more than repay the total cost of your training investment.

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If a methods or time study man can in one year reduce the cost of production by only 5% for less than ten people who earn an average of $50 per week, his training costs are more than recovered.

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Think of the department or group in your plant who is charged with the responsibility of reducing costs.

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What is your criteria of the success of their department? How vital to your competitive position is successful cost reduction today? To most of us it is very important. As such, the values of the use of the new technique as found by the present users of the procedure, should be considered in light of your own position.

Discussion of Mr. Bugbee's Paper

The Chairman of the meeting was Paul W. Bennington, Chief Industrial Engineer, Steel Company of Canada, Hamil-

ton, who introduced Mr. Bugbee. At the conclusion of the paper he said:

Thank you, Mr. Bugbee, for a very clear summary and outline of MTM. You can't cover everything in a brief outline, but I was thinking as I listened to your talk that one of the things that I personally like about the MTM type of analysis is this: If I take this glass of water here and move it from there over to here, it is a simple operation. In my own experience I have had occasion to check time studies and check standards and incentive standards for operations like that. A typical time study would probably say "Pick up a glass of water and move it 20 or 24 inches or something like that." And if he is a good time study man the chances are it would be "Move glass" in nine-tenths of the time studies. I want to emphasize this point for it is very important to me—if Mr. Bugbee analyses the operation of moving the glass from here to here, I could go out of the room and I would lay a ten dollar bill on that I could duplicate precisely what he has done. The point I am trying to get across is that an analysis by this type of technique leaves beautiful tracks so that anybody else familiar with the operations can tell, not approximately, but precisely what has been done.

That is a valuable type of thing in any type of work. I have frequently had occasion to examine standards of one kind and another and, as any of you people who may happen to be trained in industrial engineering know, we industrial engineers take a time study by taking the back of a sheet, drawing a lay-out of the operation and trying to picture what has gone on. But you don't get a good picture that way; but you do get a thoroughly complete picture of the operation when it has been subjected to an MTM Time analysis.

I would like now to call for any questions that you people may have.

A MEMBER: Has Mr. Bugbee not found that MTM should start at the management level first, the superintendents and the foremen first. I have had occasion to visit plants and I have not found any of them but what the foremen and the superintendents have their pets; they can not do wrong and that cuts down production very much in the plant. So I think the place to start MTM would be at that point: with the general manager and clean down to the lowest supervisor in the plant.

MR. BUGBEE: That is a very easy question to answer. I agree one hundred per cent. Our own experience in the use of the procedure is that where individuals have either upon their own undertaken the opportunity to be trained in procedure or where certain managements will say, "Fine, we will train a man" and then they expect miracles to occur because the man has been trained in the procedure—well, it doesn't happen that way. Our biggest problem here in Canada in the use of MTM is not the fact that we must train thousands of people in order to obtain results. There are companies which have sent their representatives to be trained—and they are not using the procedure today as it can be applied. The result or reason for that is lack of understanding of the benefits of the procedure by top management.

Now, I purposely have not even said what is MTM's grass root position and the various body motions that we analyse or how we do it because I didn't want to get into that type of a discussion with you because I realize that you are not, generally, the man on the floor doing the work. I have purposely tried to high-light the advantages of the procedure and hope that it will enlist your thoughts so that you may look into it a little further and consider it for your own plants.

I realize that in the Wire Association you have certain plants which are not as amenable to benefits, yet they are using the MTM procedure as are other types of industries. But I have noticed in each of your plants there are areas where you could profitably use the procedure. The type of thinking that it develops, even if it is only used upon occasion, is very beneficial in the training provided your technical men so they can reduce costs to improve your competitive position. As I see it, it is not a cure at all, but it does provide an additional tool to train people.

Now, Management's position today is that we have to start at the top to say we are behind the company's reduction procedure and take methods that have been analysed and approved and have them followed. And, in many cases, as you pointed out, there are little pet people that certain foremen have—and over the past few years, though it is not quite so prevalent today, but certainly in the past the foremen were the rate-setters for rates of production or units of production that we were to gain from our machines and as such, if they liked an individual they would have a different rate for this operation as opposed to another operation.

Your point is well made and I concur wholeheartedly.

CHAIRMAN BENNINGTON: Mr. Bugbee has indicated that he would be willing to give a very short explanation of the basic concept of MTM, that is the basic motions and so forth. I think it would probably be in order for you to do that, Mr. Bugbee, if you would.

MR. BUGBEE: Gentlemen, MTM has broken down the various motions that people perform in their every-day life into about eight or nine basic classifications. Now these motions apply whether we are in this room, whether we are in our home, whether we are in our office or whether we are in a factory. A cigarette, a tool, a part, it makes no difference. An object, let us say, by itself if easily grasped is a case, BR. My hand is here and I must reach for that part; it is going to be approximately an R12B, which means in MTM "Reach 12 inches; Case B, object by itself easily grasped." So it is reach and then a simple grasp. It is "Move—position—release." We work in a basic pattern of reach, grasp, move, position, and release.

Of course you can have additional moves; you might not have position; you can have applied pressures, turns and other things thrown in, but to even pick up this glass of water or this glass, I reach, grasp, move, and release. If I had to position it to an exact position, to relate it to something, that would be a position. If the waiter is setting the silverware on the table or the typist is putting paper into the typewriter and rolling the platten, she is performing the same basic manual motions and when they occur, you can analyse them with MTM procedure and assign the same time value to that motion.

We have reaches in several cases; we have moves, grasps, different types of grasps, position. As you know some objects can go in—such as this pen—in this way. I can rotate it completely through 360 degrees and that is a symmetrical position. Others like a hex object or a light plug that goes into the socket can go in in two or more ways. Then we have the non-symmetrical position where we have an item that can only go in in one way. We have turns, as we turn our hand about the longitudinal axis of the forearm. We have applied pressures, as we will push the turn valves to finally tighten—things of that nature—or to disengage. It is characterized by the sudden ending of resistance. As the resistance of removing the cap end (of my pen), notice how my hand flies off. That is what we call "disengage."

We have body motions: turn body is a simple case of turning the body. Case One is where the foot, the leading foot, strikes the floor and then you can reach or do other work. Case Two you turn your body. Case Two is the type where we turn and our lagging foot must come up as we get set to do something. We have side-steps; we have walking; we have walking under obstructed position where we have oily floors, sandy floors in and around objects, such as you find in tight areas where there are machines. You have walking with loads, carrying heavier weights; and bending. We reach to an object at or below the knee, and so on.

We have eye travel, eye focus. Each of those has a predetermined term.

How much time do we have? We could put on a little demonstration but I don't know, I wonder if we have the time. But those are the basic motions that we use in MTM. Just for a moment let us say that Paul was reaching for the glass of water, moving it and setting it down at the other end of the table. We would have our analysis of left hand move: he reached for the glass with the left hand. He performed a reach; he also sidestepped approximately 12 inches; he then grasped the object—he reached for the object and grasped it and in moving it, he performed about an 18 inch case B move with a side-step of 12 Case 1; then he released the object and returned to his normal starting position of his side-step. At the same time his hand was coming back in the general area so it would be a R10E.

There are too many things to talk about to give a full explanation, but the symbol reached is 8 inch Case B. Then you would have to know the definition of Case B, which is a simple grasp, a move combined with a side-step, a release and then a side-step back and a reach ten inches. We put down under a description on both sides what we are doing, so you would find then a description of reach to glass on table. If you had to record the motions for operator training, you would tie it down to exactly where it was, the type of situation. You could say "Grasp object," or as you got into a more complex type of grasp, give the exact type of grasp to be used. What is the key point of positioning your hand in order to gain best control of the object? Then a move making a side-step to the left as we set the object down—and if we had a specific area we would also say where.

So we can look at it, from this, if fully trained, and know what went on; we can look at it from here and have a complete verbal description of the

work performed.

Now there is one thing I might like to take a minute on. You are in the Wire business—and this pertains to wire. In Pennsylvania — or rather in Ohio, there happens to be an organization that makes a lot of electrical products for radio and T.V. They had an operator —in fact four operators taking short bare wires of about this long out of a shot glass, reaching for the wire, grasping it, moving it, and positioning it in a glass. This shot glass had the wires all in it and there were a series of drilled holes they were positioning these wires into because the next operator then positioned an object on top of the wires in the making of resistors. What was happening was that the operator had to make a Case C reach—and let's use a value of 12 for the moment—she had to make a complex type of grasp; she had to make an accurate move followed by a position of setting the object into this unit and a release. Through MTM we made an analysis of certain motions. We spend nickels and dimes all the time without thinking of the cost, though we don't like the dime for the nickel candy bar—but we don't question; but when it comes to the dollar or to five dollars, we think and at $10. or $50, we take a second thought if it is out of our own pockets. Sometimes it is the company's pocket and we might not apply that, but I think most of you still do. We know this is a highest control grasp and the highest control move—the very highest type of position and release. And through a simple method of changing those wires around so we could make a simple G1A type of grasp, like where you put the box in and you reach to the lip and pull out a match—we set up the wires in that manner so that you could always reach to a fixed position. You reach to the gear shift of your car without looking; there is no control; you could look out the window and still reach to the gear shift. We changed this to allow a control reach; the grasp which was performed was the simplest type of grasp; we then had the same obvious move because it was an accurate move but the position, by the fact that somebody had overlooked the fact that they had not bevelled in the hole, had required the operator previously to line that up and put it straight in. We now opened the hole up and we were able to change this position to A-3; P2S; and R-1, an exact saving of 95%. The net on that one was a $45,000 saving and that was a highly competitive operation. We look at the control and try to go down to the lowest units of time that we can.

So little things that crop up as a result of MTM analysis do allow you to make savings. Now, that applies on a wire in a reel—change the type of lever that the individual reaches to an accurate reach he might have to make because of something in his way, change the type of grasp and the move—if we can work around opposition to reduce the degree of control that the operator must expend in order to reach for and grasp something, then we are saving time, particularly on your large stranding machines and the other types of machines. High process control—those little changes which when multiplied by the number of reels that we have to change in those machines do have a definite bearing on the amount of time and consequently on the cost of operating that machine. As such, there are areas where I say it can be used. I do not intend to say I would use it on every operation in your plant. In the Wire Industry I have seen, more than in any other type of concern, where the use is limited for it; but by the same token I feel it beneficial in certain areas.

A MEMBER: You mentioned that people have a tendency to resist change. If you set up an incentive program based on MTM and a grievance came up from the employee which was basically a resistance to change, how would you go about explaining your standards based on MTM in a language that both the employee and management could understand?

MR. BUGBEE: That is a good question. What I meant by resistance to change was the idea that before, without setting up the job properly in the first place, we tell Joe to go over and run the machine. Joe does the best he can but Bill, the foreman, comes over and says, "Joe, I don't think that is quite right, quite the best way—if you try it this way, I think it would be better." So Joe now does it Bill's way. As a Methods Engineer we come into the picture and see further changes can be made and now we are criticizing Joe and now we are criticizing Bill—and Joe is now making another change. If we find our first idea is incorrect, we have to go back with another one. The key point I was trying to make in this idea of change with this procedure is that in many cases we can set up the best method in advance and train the operator accordingly and avoid that situation.

To answer your direct question of how we do explain an MTM standard in language for the operator to understand, it is a question of sitting down over a table or in some other area right at the work position, preferably, and say, "Do you reach 12 inches to where you have to locate the object, so that you are going to make a search and select the object to be grasped?" "Is it 12 inches? Do you have to reach?" Then the next point: "The objects are jumbled. Do you have to have a jumbled grasp—in this case G-1-C—as interference?" "Can you get the object easily or do you have to work your fingers in and around the object?" If it is, that is it. Then, do you move? What do you do with the object next? "We have to move it; we have to move it exactly because we are going to position it in a small hole." "Is the distance 12 inches?" The class of position we can show—we have these various loose classes or a fit. "Is it an exact fit?" "Is it a delicate precision job?"—Obviously it is, in this case, but you can explain the fact that it is symmetrical if it can go in any way or not, if it can't. The first thing we want to do is put it in symmetrical or non-symmetrical. If you have to, you can go through each and every motion that the individual has to do—and you can do that for training operators or to sell the standard. The idea, of course, is that you don't want to have to do that. Try in all cases to explain to one in your crowd, preferably at least to two in your unit; bring them into the situation; let them know there is nothing you are trying to hide in your analysis and set-up of standards.

The most successful users of MTM have trained union personnel and had appreciation courses where there would be an hour or two hour session of bringing in all the superintendents and the foremen and the business representative so they know the method, know about the procedure; know its fairness and that there is nothing to hide—for with this procedure it is "Cards on the table." You either make the motion, or you don't. If you don't make it, then we have to put down what you do do.

A MEMBER: I think a lot of your answers would come out in work simplification—in making a study of the job, before studying for an incentive. I worked in a plant where they put 150 per cent ceiling on our incentive and the management wanted to take the ceiling off. The industrial man wanted to make it right for the man that hit the top. The management said that in any new standard, you couldn't have a ceiling on it. We had an operation on abrasive cloth and the man had to cut a bar and deburr it; and they wanted to tighten up on the standard; they got the shop steward. He said "I know it is impossible; you can't do it; that man will never make any money on that job." We took the operator, called him into the office and told him we wanted to test the standard and asked him to do the best he could for an hour; he worked for an hour on the job and the industrial engineer studied him and said, "The man is making 200% in the hour." Yet he said they could not make it when first given the rate on it. They found out that, through the work simplification study made at first, the man they thought was the best operator was not doing it the best way. The first man was filing the bar; the fellow on the night shift was rolling the bar along the file and took the burr off as he stripped it off the machine and he made 200%. Yet they said it was impossible to make 150%.

MR. BUGBEE: I think you are right. Any time an individual makes 200% on a standard, I feel there are two answers. First of all, the standard is probably not correct because the number of super-skilled operators that we have in industry who can make 200% are very few—the percentage of them. MTM standards are based upon an average operator with average skill, giving an average performance, so that he will make the standard and be able to make it day in and day out, week in and week out without any health injury and so forth.

We find—and that has been checked time and time again—that the MTM is the same concept as a good level time from a time study. They are the same. There is no difference in the situation. When I say that is good, some of us will have a different time study concept; but to take it across the board, what is 100% MTM is your 100% concept. As such we find the bell-shaped curve applying to people on incentive running from 120 to 135%, depending on the amount of machine control that is in there, so that the earning potential is obviously governed by the manual content. Any time it is 100%, there has not been a thorough study. In this case the MTM is the logical outgrowth of the motion study work done by the Gilbraiths and the time study work done by Taylor. If I had 40 motions and changed it to 12, I would have no idea of the resulting time unless I had taken a picture of the operation with a time study; I have to have somebody on the

(*Please turn to page* 724)

Applications of Koldwelding

by W. A. Barnes, Vice President
Utica Drop Forge and Tool Company
Utica, New York

This paper delivered before The Wire Association at its Montreal Regional Meeting on May 8, 1953, goes into the history of the cold welding process and describes its present applications. It was followed by practical demonstrations of cold butt welding, in which copper wire was used.

Historically, most metal working operations have been preceded by heating the metal. As knowledge of the workability of metals increased, it has been found that many operations can be performed without prior heating. The elimination of the heating effects important economies and conveniences and, in most cases, can be the means for advancing the operations from job lot to mass production basis.

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In the field of welding, the application of, or generation of heat in some form has been an essential feature. By increasing our knowledge of cold metal flow and of the surface conditions at the interface to be welded, we are now able to design purely mechanical means which will prepare the surfaces to be welded and produce welds which are strong, dependable and of considerable economic significance in a number of industrial applications.

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In common everyday language, this is Cold Pressure Welding. Metallurgically speaking, it is a solid phase bond. Commercially it is known as "Koldwelding" spelled with a K.

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Koldwelding originated in England and was developed in the Laboratories of the General Electric Company, Ltd. (no connection with the General Electric Company as known in the U.S.). It originated in observation by a young English aviator who was injured in the war, Sowter. He observed that when two sheets of certain metals were cut by dull shears the metals stuck together along the cut edge. He observed that this did not happen when he used sharp shears. He also observed that the adherence of the metal edges was something more than just a stick, it had the qualities of a weld.

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Over the past few years a small group of research men in the General Electric, Ltd., laboratories near London have developed these observations into a truly amazing array of fabricating processes and operations. They have determined the cold pressure weldability of practically the entire list of pure metals and of many of the alloys. Out of this work there is now emerging a number of highly significant practical applications.

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The English have advanced the Koldwelding art farthest with the softer aluminums such as the EC grades and 2S and 3S alloys. In these materials, Koldweld butt welds can be expected in wire which will equal the original wire strength.

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About a year ago, the Utica Drop Forge and Tool Corp. of Utica, N. Y., became interested in Koldwelding. There appeared to be a number of applications of economic importance but they all required special tooling and no such tooling was available. Utica Drop Forge and Tool Corp. is one of America's oldest manufacturers of quality hand tools. Here was an apparent need for high quality accurately made hand tools and Utica Drop Forge had been specializing in high quality hand tools for over 50 years. In recent years, Utica Drop Forge had become very active in the manufacture of jet engine buckets and blades where accuracy in forging and finishing operations were paramount. A working alliance with Koldweld was a perfectly logical procedure.

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Now to retrace our steps a little and give you a description of Koldwelding and of the history and background of the art previous to Sowter's work.

Phase I—History and Background

Koldwelding is a process of joining metals by means of homogeneous welds produced solely by pressure at room temperature. Neither electricity nor heat are necessary and no flux, chemical or gas is used. When a weld is completed, there is no scale to be cleaned away, and the process can be carried out by an unskilled operator.

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The art of pressure or solid phase welding with heat is an old one. As early as 3000 BC the Egyptians heated iron ore in a charcoal fire to reduce it to a spongy iron, the particles were then welded together by simple hammering. In 1829, Wallaston produced sponge platinum and welded it together by cold pressing, sintering and then, hammering while the metal was hot.

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In 1891, James H. Bevington patented a method of closing or

joining tubes. The process called for pushing the ends of the tubes into a die revolving at a rate sufficient to heat the metal through frictional contact, thereby softening the metal and causing it to effect a weld.

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In 1903, Alexander Dick devised a process for welding copper, copper alloys, aluminum, and similar metals. The material to be welded was first heated; then the oxidized ends removed by a saw or wheel. Immediately, the cleaned surfaces were brought together under pressure and then forged.

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In 1921, John L. Fate evolved his method of sealing a vacuum jacket. After the jacket was exhausted, the walls of the exhaust tube were flattened by using a specially designed pincers. A current was then passed through the pincers to produce a weld.

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A paper written by H. Herrmann during the war and obtained in Germany by an investigating team is titled, "Pressure Welding" and deals with the manufacture of a light-alloy charge cooler element used with the Jumo 211-F engine in the Junkers 88 aircraft. This charge-cooler was hot-pressure welded from an aluminum alloy known as "Pantal".

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Cleaning was a very important step in the procedure and was effected by dipping the material for one-half minutes in 15-20% nitric acid at room temperature, rinsing in water, dipping in 15-20% sodium hydroxide at a temperature not over 50 or 60°C., rinsing in water, dipping again in 15-20% nitric acid and rinsing again in water. The material was then dried in an electrically heated furnace and the side to be welded was wire brushed.

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Any fingerprints left on the sheet produced a faulty weld and could be removed only by wire brushing or grinding.

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Two sheets of Pantal, each 0.4 mm. thick, were pressure welded together in elaborate dies heated to 420-480°C.

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Further precautions were necessary to prevent the dies sticking.

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A study of abstracted bibliographies reveals, as above, that all early pressure welding was done with heating.

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The work of Sowter has resulted in establishing certain principles of Koldwelding as follows: Koldwelding can be defined as the effecting of a weld without the application of extraneous heat. In this paper, we will deal with materials welded by pressure alone—the only heat involved being unappreciable localized heat inherent to the rearrangement of molecules.

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Making a Koldwelded joint requires two steps:

1. **Preparing and cleaning the specimens.**
2. **Applying the pressure required to make the weld.**

A power driven rotary steel wire scratch brush can be used to disperse the oxide layer on the surface to be welded. This step is of great importance in that a poor cleaning or no cleaning may result in a faulty weld. This operation should be done immediately prior to welding but satisfactory welds can be made several hours after scratch brushing the surfaces to be welded. It should be mentioned, however, that the scratch-brushed surface cannot be contaminated by grease, moisture or fingertouch. A device capable of producing and controlling the required pressures is necessary for the second step of the procedure.

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In Koldwelding sheet, the success of the weld is closely dependent on the correct relationship between the stock thickness of the sample and the dimensions of the welding die. Both the depth of penetration and the width of the weld are governed by the gauge of the metal and the type of the metal.

The speed with which the weld is made seems to make little difference in the amount of deformation required or in the strength of the welds. The essential part of the Koldwelding process is that the clean surfaces of the sheets to be joined be brought together during deformation so that the atoms of one surface are pushed into the atom structure of the other and the interface between the two is eliminated completely. This is possible with the more ductile metals; they are forced into intimate contact, and, as they flow laterally from under the punches, the atoms of the two surfaces form a solid phase bond and a weld is formed. Friction between the flowing metal surfaces results in seizure and aids in welding. Since welds can be made by applying pressure very slowly, there is little evidence that the heat of deformation plays a part in the cold welding of aluminum. In the past, the function of heat in pressure welding was to increase the ductility of the metals, allowing them to be placed into more intimate contact at lower pressures, as well as to increase the mobility of the atoms. Considerable cold work will exist in a Koldweld.

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When two strips of sheet metal, Koldwelded together, are pulled in tension, putting the joint in shear, failure occurs at the periphery of the necked-down section of the strip (when considering the lap type weld). The welded area remains in relief on one strip; a hole appears in the other where shearing took place. The breaking load (in pounds) has been found to be the only accurate measure available to determine the strength of the weld.

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Koldwelding of sheet may be performed in hand pressure tools, power pressure tools or by impact tools. Intermittent or non-continuous closing of the dies or repeated blows are to be avoided.

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Koldwelding of foils or sheets under ten thousandths of an inch in thickness can be done by single impact tools and if sufficient care

is exercised to keep the as-rolled surfaces clean and free from contamination, the scrap brush cleaning can usually be avoided.

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Koldwelding of wires has been done in various ways by the English. Lap welding, cross welding, spot Koldwelds between adjacent or twisted wires, direct welds between a small and a large wire, etc., all of which require prior cleaning. However in the English pioneering of Koldweld buttwelding of wire, they have provided a two step process which eliminates the prior cleaning. Since an accurately squared end on the wires to be buttwelded is necessary to maintain alignment, it becomes easy to provide a clean surface at this point by simply cutting off square immediately preceding the welding operation.

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The wire to be Koldweld butt welded is held in suitable dies, accurately aligned so that the square cut ends of the wire are firmly held and project the proper distance from the die face to provide the correct amount of metal to form a flanged upset when the dies are forced together. The proper proportions of a clean square cut end, proper length of projectors, firm holding and close alignment are all critical for each diameter of wire and change of material to be welded.

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The results obtained in the Koldweld butt welding of aluminum and copper wire are of great significance to fabricators of such wires. With the flash remaining on the weld, aluminum wire can be expected to break outside the weld area under any type of test. With the flash removed flush with the wire surface, we can expect about 90% of the strength of the original wire in the weld area. With soft copper wire, the work hardening of the metal in the weld area causes the softer adjacent wire to neck down under a tensile pull and the break will occur outside of the weld area even with the flash removed.

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Wires which have been welded and the weld flash trimmed can be expected to stand subsequent drawing operations necessary to reduce the wire to smaller sizes.

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Aluminum and copper strip and square wires can be butt welded, also wires of different gauges, and aluminum can be welded to copper. Holding dies have to be provided for each shape and in most cases, individual die sizes have to be provided for each change in gauge of wire.

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The smallest wires we at Utica have been able to Koldweld buttweld to date have been .020" in diameter. We do not intend to work much smaller than this figure for the present because of the practical limits of accuracy for production made tools. There seems to be no inherent or basic reason in the Koldweld process which makes it impossible to weld finer wire but the accuracy of alignment of the dies and the accuracy of the die work for such fine wires causes the design and manufacture of tools for these small sizes to be delayed beyond those for larger sizes.

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A great deal of practical research and development has gone into the design of the dies to hold the wire for the Koldwelding operation. Fast loading, positive gripping with no slippage and fast release of the welded material is very important in a tool to be used by workman in competition with other means of fastening wires together. Also, fast and easy change of dies and of cutters to accommodate the different wire sizes.

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In some cases, it will be possible to weld either copper or aluminum of the same wire gauge in the same dies and cutters, but this cannot be expected to be a general rule especially in the larger sizes.

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In butt welding, a clean surface is prepared by the squaring cut. This operation is also the guaging means for obtaining the proper projection of the wire from the dies for best welding.

The technique of cutting is critical and varies from material to material, temper to temper of material and size.

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To date, we have developed tools for butt welding solid wire from .020 to .256 and plan to go to .375. The larger sizes will require power driven tools. We have also developed stripping mechanism to strip the flash from the wire so as to provide a smooth surface for wire drawing, insulating or other operations.

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Homogeneous coverings on the wire, such as Alcladding, tinning or plating have little or no effect on the butt welding of the wire. Various insulation coverings present individual problems.

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Stranded or bunched wires can be Koldwelded as a group. To do so, however, involves an entirely different tooling set-up and different technique from that of welding single solid wires.

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It is practicable to butt weld different diameters of solid wires within certain limits.

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Single solid wires can be lap-welded, but to date we have not developed tools for this type of joining because of the inferiority of the overall structure to that of butt welding.

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Tools are not as yet available from production. To date, all tools in use in this country are handmade models. They are being used in wire fabrication such as joining wires in wire cabling and insulating operations. The practicability of these tools for wire joining during the wire drawing operations has been proven both on aluminum and on copper wires. Welds have been made in large wires, the flash stripped and the wire drawn thru high speed machines into fine wire. The welds cannot be detected in the finished wire.

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Wires have been Koldwelded

with various other types of welds such as cross and T, by the English. However, in making these types of welds the wires have to be cleaned first and the weld efficiency is low compared to butt welding. But little work has been done in this country on these but it is expected that crossed wires can be welded into fencing and wire screen. Each size and temper of wire must be held in properly designed and close fitting dies.

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The Koldwelding of stranded wires can and has been done. The wires are scratch brushed and compacted in special dies. The grouped and compacted wires may be welded to the side of a sheet or lug or may be incased within a tubular or hollow portion of the lug or other part and the assembly Koldwelded into a solid unit. Electrical resistance of such welds is very low.

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The Koldwelding of the longitudinal seam of aluminum tubing is in production in the U.S. Butt welding of tubing has been done both aluminum to aluminum and aluminum to copper.

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Koldwelding of solder is perhaps the easiest of any metal or alloy to join. Excellent joints are obtained and low pressures are required.

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Koldwelded joints are extremely resistant to gas or liquid leakage. Truly waterproof or gasproof joints can be obtained. They should be kept in shear and not in direct tension for the higher pressures.

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Koldwelding of silver or copper contact surfaces onto aluminum bars is in production in the United States.

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Eventually it is expected that Koldwelding will enter certain phases of aircraft manufacture. Best weld efficiencies are obtained when the metal is in the soft tempers. Assemblies can be heat treated after Koldwelding and very good weld performance obtained.

Tools have been designed for the lapwelding of sheet and are being built for early delivery. Tools for the welding of foils have also been designed. Tools for butt welding of wire will be somewhat delayed because of the wide range of sizes it is necessary to weld in order to cover the commercial ranges. Small wires will be butt welded in hand tools, larger wires in power tools. Since the pressures built up are of the order of twenty tons to butt weld a 3/8" diameter copper rod, rugged tools must be provided.

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Due to literally thousands of inquiries from manufacturing firms who have specialized problems which can profitably utilize Koldwelding, a service has been arranged wherein Utica Drop Forge and Tool Corp. will evaluate each individual problem and its probabilities of success as Koldwelded, design under contract necessary production tooling and, thru tool and die making connections, furnish such tools. Such contracts are taken only after an exchange of samples which gives the client a fair indication of what he will get. In some cases, it is necessary to make a charge to cover the sample cost due to the expense of special die work.

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Koldwelding is covered by over forty pending patent applications in the United States. These patent applications cover every phase of basic process and details of necessary tools.

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The purchase of hand tools from Utica Drop Forge and Tool Corp. for Koldwelding carries with it the right to use such tools as purchased. Therefore, in purchasing a tool from Utica it is not necessary to take out a license or pay a royalty to use the tool. The royalty is in the price of the tool. This arrangement also will go with the larger power tools for welding heavier wires and power tools for hand operations on other types of welds such as lap welding of bus bars.

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The use of Koldwelding for production processes such as in punch presses of special production machines necessitates the obtaining of a license to so operate the process from the Koldweld Corporation, 10 East 40th St., New York, N. Y. Therefore, to have Utica design and furnish a special Koldwelding die to perform a welding operation such as for use in a punch press, it is required that a manufacturing license be taken out from Koldweld. The license fees are reasonable and the license need not be taken out until approximate samples have been exchanged.

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An instance of the specialized applications of Koldwelding is that presented by the aluminum window industry. Almost every manufacturer has one or several extruded or rolled shapes each of which will require especially designed tools to Koldweld.

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Utica has received inquiries from thousands of companies and individuals throughout the world and has also received hundreds of samples of specialized applications. It is intended to carry on continued research, development and application engineering into every practicable phase of this new method of joining metals. Special tools will be developed for the specialized applications. It is expected that many of these will become standardized and standard lines of hand or power tools will emerge to fill the need. The first of these lines of tools will be those for butt welding the range of commercial sizes of solid aluminum and copper wires. Other lines of tools and extensions to other metals and alloys will come in time as the knowledge initiated by Sowter's observations is increased by our study and experience.

Discussion of Mr. Barnes' Paper

Taylor Cornelius served as chairman of this session. He is Assistant General Manager of the Aluminum Company at Montreal.

CHAIRMAN CORNELIUS: Let me thank you, Mr. Barnes for your very interesting talk. Before we start on the general questions I believe there is a written discussion on this paper. I will call on Mr. Whitney of the Copperweld

(*Please turn to page* 719)

Shaving for Non-Ferrous Wires as Practised by Canadian General Electric Company

by G. J. Moher, Manager of Methods—Wire and Cable Section
Canadian General Electric Company, Ltd.
Peterborough, Ont., Canada

A paper presented by the author at the Montreal Regional Meeting of The Wire Association on May 8, 1953. Mr. Moher describes various processes by which good wire surfaces are produced, among them rod shaving. The reasons for and advantages from this process are pointed out.

The trend toward smaller and lighter electrical apparatus of higher ratings has been made possible by the development of electrical insulation with superior dielectric, physical and heat resistant properties.

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Insulations of better dielectric character meant thinner walls could be utilized and these thin walls facilitated heat transfer or dissipation from the windings. Both of these factors made for smaller apparatus of equivalent electrical rating.

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However, the thinner the insulation applied to the surface of a magnet wire, the more important it became that the metal surface of that wire be perfectly smooth. Slivers, fins, seams, burrs, laps, checks from the set surface of the rod, and copper dust, were all hazards that one had to contend with when attempting to insulate wire made from standard hot rolled copper rod and drawn by conventional methods. The inherent disadvantages of the projecting type of defect are readily apparent. The effectiveness of an .002″ film of Formvar, for instance, is depreciated if a sliver of copper protrudes through the film or even part way into the film.

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Not so readily apparent are the results of the depression or surface porosity type of defect. The majority of thin walls comprising magnet wire insulation, are built up by successive dips and bakes of an enamel solution or emulsion and any surface depression is capable of holding air, wire drawing compound or grease. All of these materials will expand in the heat of the enamelling oven and can and do cause blisters in the enamel film. Those of you familiar with the enamelling art, will readily agree that once a blister starts, subsequent enamel coats only accentuate the condition.

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From the standpoint of the design engineer, who makes use of the wire in apparatus, the elimination of surface defects in the wire could be conceded as being most important. Perhaps not so apparent, and not given the attention it merits, is the fact that a perfectly smooth, clean and dust free surface on the wire fed to the enamelling room, can reduce the amount of scrap wire produced in the enamelling process. In fact, the added costs in obtaining the superior bare wire can be more than balanced by the reduction in coated wire losses.

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A good many individuals and concerns have spent time and money over the years towards developing the best possible wire surface. A brief listing of some of the methods follows:

1. Open Fire Anneal—involved heating the rod in an oxidising atmosphere, then quenching in water. Successive applications followed by pickling resulted in the elimination of most of the surface defects. This method was inherently expensive and considerable of the copper removed was lost.

2. Sand Scouring was used and removed the projecting defects but was prone to leave depressions in the surface. Also salvage of the removed copper was difficult.

3. Scalping the wire bar has been used and is still in use. This process removes the set surface and the area of high oxide concentration. This operation is effective but the deficiencies of the hot rolling process can result in many surface defects in the rod subsequently rolled from the scalped bar.

4. Improvements in Methods and Control of the Heating and Rolling operations performed on the wire bar have been effected and have resulted in better rod in some mills but the results were never 100%.

5. Extrusion rather than rolling the bar or ingot to rod form, has been used with very good results. The expense of the operation and the difficulty inherent in getting long lengths have been drawbacks in the case of this process.

6. The Shaving Process involves removing the surface from the partially drawn hot rolled rod. This is the method adopted by the Canadian General Electric Co. to obtain a superior surface on bare wire and make possible the manufacture of high quality magnet wire with special reference to the film coated types of both round and rectangular cross sections.

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The Shaving Process, as used at Peterborough Works, is covered by U.S. Patent No. 2,233,928 (Canadian Patent No. 396,181) granted to Mr. C. E. Weaver and assigned to the General Electric Co., Schenectady, N. Y.

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The machine used is known as a four block Trollrod and is illustrated in Figure 1 and Figure 2. The hot rolled rod is reduced between one and two B&S reductions

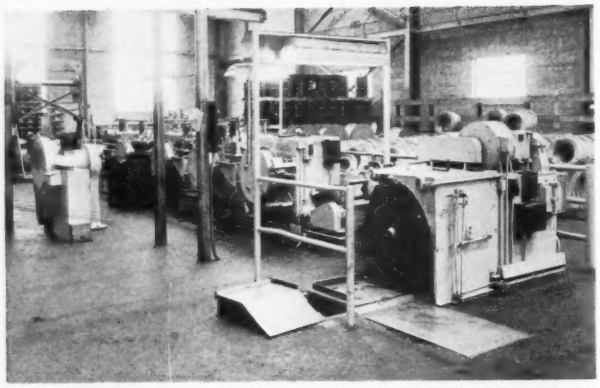

Figure 1.

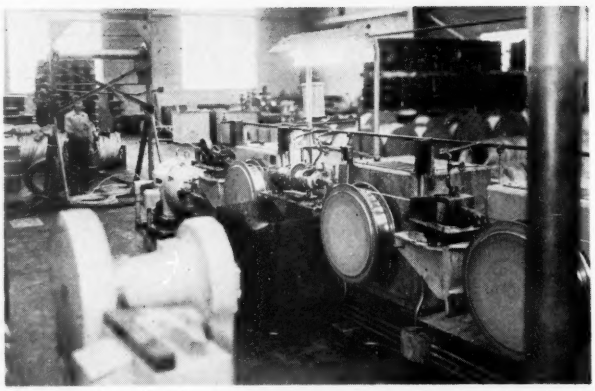

Figure 2.

in the first die. This reduction is made for several specific purposes.

1. It gives a truly round material on which to work.

2. It thins out the defective surface which we wish to remove, and so cuts down on the amount of material necessary to scrap.

3. The work hardening done on the rod, facilitates the operations of both the "Chip Breaker" and the Shave Die. If these operations are attempted on the unworked hot rod, trouble is experienced due to the plastic nature of the soft copper.

★ ★ ★

After the initial draw, the "Chip Breaker" goes into action. It is shown in Figure 3 and is really a scoring device utilizing two carboloy tools which are driven by the forward motion of the wire and scribe two helical grooves in the surface of the rod. Prior to the development of this device, continuous shavings were produced at the shave die which fouled up the shaving head and were difficult to handle. With the Chip Breaker operating properly, chips are produced at the Shave Die which are readily cleared by the air blast and lodge in the container provided as illustrated in Figure 4.

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From block No. 1, the wire is fed to the Shave Head which is depicted schematically in Figure 5. It is observed that there are four dies mounted in this head. The purpose of the dies, other than the shave die, is to ensure a straight length of round wire being fed in proper alignment to the Shave Die. The first and last dies are conventional wire drawing dies but the guide die, as it is known and which is located just ahead of the Shave Die, is of special shape and is adjustable by means of four screws so that it may be aligned with the Shave Die. The aligning operation is satisfactory when a uniform thickness of chip is being removed around the circumference of the wire. Following this alignment adjustment, it is good practice to check the setting of the Chip Breaker. The blades should be set so that the chips come away cleanly and so that there are no tool marks visible on the wire as it comes from the shave die. For illustration purposes, the following string up of dies will be considered as being installed in the Trollrod

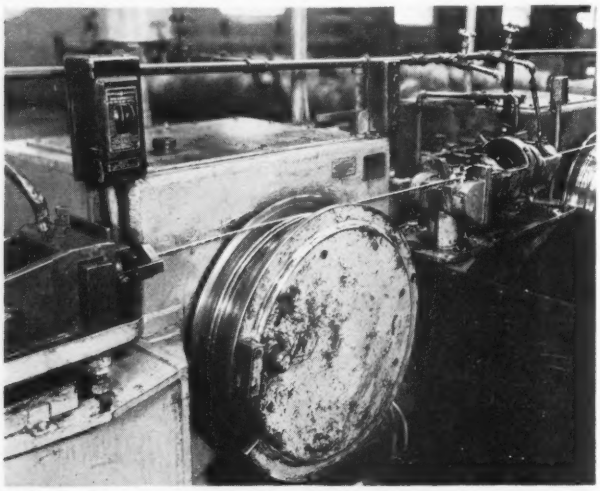

Figure 3.

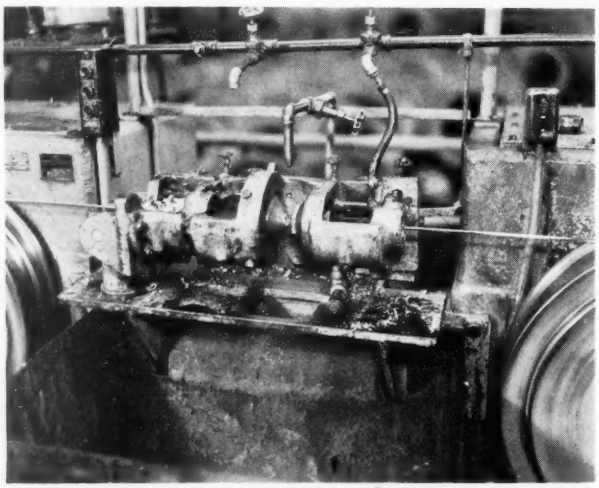

Figure 4.

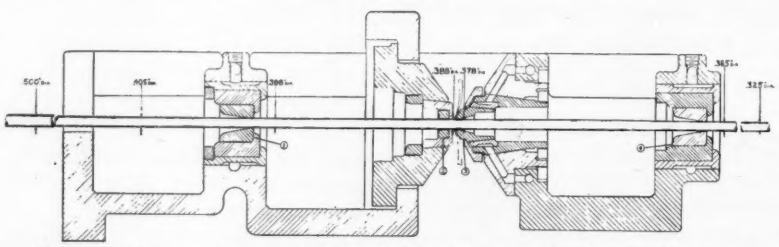

Figure 5.

	Die Numbers						
	1	2	3	4	5	6	7
Rod Size	First Block	Front Die	Guide Die	Shave Die	Back Die	Third Block	Fourth Block
½"	.405"	.398"	.388"	.378"	.365"	.325"	?

with ½" rod being fed to the machine.

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The fourth block may or may not be used depending on the size requirements of the finished wire and since this block is driven by a variable speed hydraulic unit, a considerable amount of latitude may be exercised in selecting a die for use ahead of this block. This feature facilitates production of the quite considerable number of sizes of round wire required as feed to the flattening mill so that we may produce the wide assortment of dimensions of rectangular wire demanded of us.

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Referring to the table of dies, it is seen that the guide die is .010" larger than the shave die and so in this case, approximately .010" will be removed from the diameter of the rod or .005" on a side.

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The Shave Die is cooled by an air jet which also assists in removing the chips. All the other dies are cooled by a water jacket in the die block and the capstans also are water cooled. The wire speed through the shave die is in the range of 200 to 250 feet per minute with one operator running the machine. Common rod sizes fed to the machine are 3/8", 1/2", 5/8" and 3/4". Our original intent was to use 7/16" rather than 3/8" rod but the 7/16" rod became not available in Canada shortly after we commenced shaving. The percentage of scrap involved and the footage one shaves per ton of metal, makes shaving of small diameters a questionable practice.

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Due to machine limitations and the difficulty of the operator keeping coils of rod welded ahead of the machine, our shaving speeds are reduced for the larger sizes of rod.

The finished wire is taken up on a 36" dia. reel of theoretical capacity 2000 lbs. However, it is common practice to see 2800 lbs. on one of these reels and a full reel of finished wire is shown in Figure 6. The copper chips, the bi-product of this process, are bailed and disposed of as No. 1 copper scrap. Although the amount of copper scrapped in the process of shaving is high, a good price is obtained for this material and so the net losses are considerably reduced.

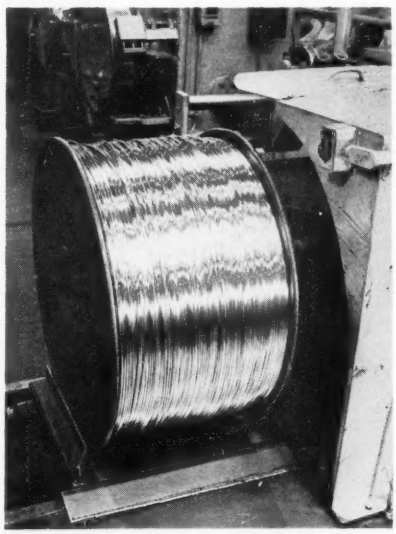

Figure 6. * * * * * * * *

At Peterborough, all rectangular and square Formex Wire is shaved before it is rolled or shaped to size. All round wire for enamelling, larger than .0403", is a product of the shaving mill and in both cases the aim is to get a perfectly smooth surface to which to apply the enamel.

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In the case of drawing fine and super fine wires, it has been found very helpful to use shaved wire. For wire sizes smaller than .0063", much better drawing machine efficiency is enjoyed and larger packages of finished wire result from eliminating defects by shaving, which would otherwise be drawn down and eventually result in breaks in the fine wire drawing machines.

★ ★ ★

In our experience in enamelling unshaved copper, the greater difficulties were due to surface defects in the copper wire with dust a source of trouble. We were able to contend with the dust by using rotating brushes, manila rope wipers or other scouring devices.

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Aluminum, on the contrary, proved to give more trouble with dust than with surface imperfections. Aluminum wire is easily damaged; however, with proper precautions, we found we could maintain a smooth surface through the drawing and flattening mills, but the dust persisted.

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Experiments in shaving aluminum confirmed that it would eliminate the dust problem as it did with copper. It was found that we could not shave as small a rod using aluminum as we could when copper was involved due to the lower tensile strength of the aluminum. Also it appears that more work should be done on the aluminum than is necessary on copper to get the aluminum in a suitable condition to shave, i.e., it could be that aluminum should be drawn through two dies ahead of the shaving head where one has sufficed with copper. The aluminum demonstrates a greater tendency to ball up or push back at the shave die and perhaps a different shaped shave die will prove beneficial. Our work to-date has been done with our standard copper setups and before we will be able to shave aluminum with the same facility as copper, some experimental work is indicated as being necessary. We could possibly get the surface we want without removing as much of the aluminum surface as we do with copper, i.e., .006" off the aluminum may prove as effective as .010" off the copper diameter and the .003" chip could present considerably less shaving trouble. We have not shaved enough aluminum to draw any conclusions as to the relative life of shave dies performing on the two metals.

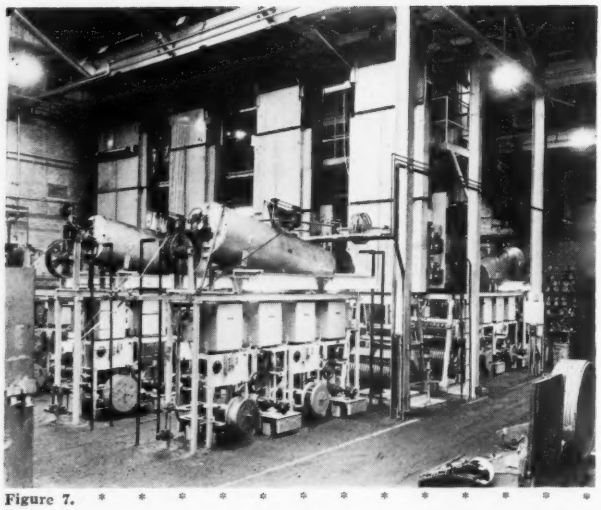

Figure 7.

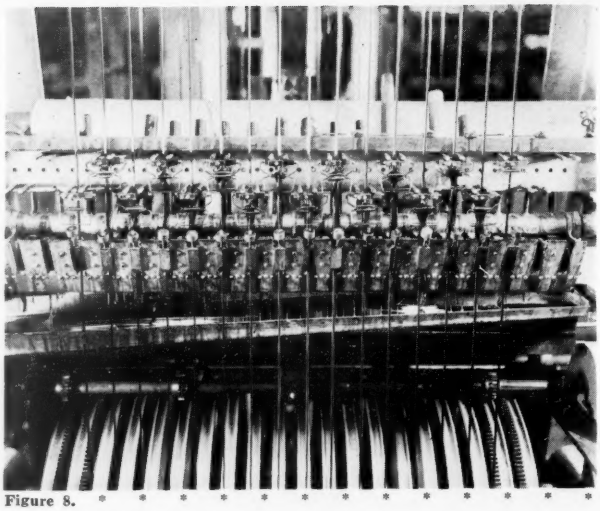

Figure 8.

As an item of possible interest, we have included photographs of our large enamelling machines where the principal benefits are derived in the wire mill from the shaving operations.

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Figure 7 is a general view of this equipment while Figure 8 is a closeup of the applicator where successive coats of enamel are applied until the required insulation thickness is attained. Figure 9 shows the operator applying a sensitive continuity test to the finished wire. This tester was described in General Electric Review, dated November 1946, as used for round wire in the finer sizes. It is equally effective in spotting the defects in the rectangular wire and especially so in the case of wire lacking the shaving operation in its prior history.

★ ★ ★

The manufacture of high quality magnet wires, both round and rectangular, which comply with the requirements of N.E.M.A. Spec. MW 24 and MW 28, is an operation requiring considerable "know how" and great attention to detail. The shaving process has made a noteworthy contribution towards our success in this field.

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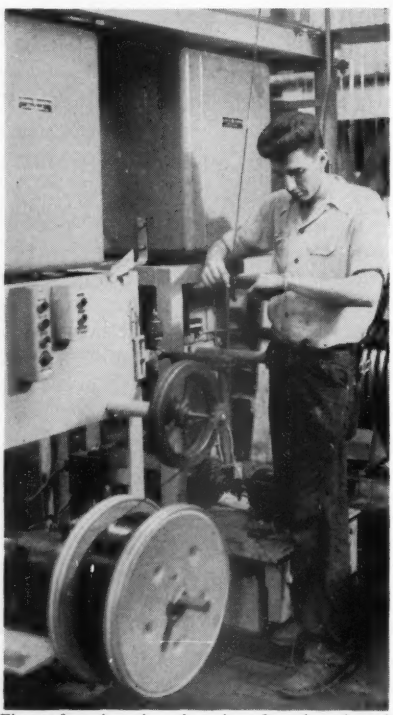

Figure 9.

Discussion on Mr. Moher's Paper

Hugh B. Carnahan, Assistant to the Vice President of Canada Wire and Cable, Ltd., Toronto, acted as Chairman of this meeting. He introduced the speaker and upon the conclusion of the paper called for comments and questions.

CHAIRMAN CARNAHAN: Thank you, Mr. Moher. I believe Mr. C. L. Sherman of Phillips Electrical Company, Brockville, has prepared a statement on this shaving process. Is Mr. Sherman here?

MR. SHERMAN: This paper on "Shaving for Non-Ferrous Wires" as conceived and very ably presented by Mr. Moher has been, I am sure, of very great interest to this gathering. It is of particular interest to myself as a representative of Phillips Electrical Company (1953) Limited who produce hot-rolled copper rods, some of which are used by Mr. Moher's company, and bare and insulated wires and cables including round, square and rectangular magnet wires.

We are happy that a paper of this type was included in the program of this meeting as it will undoubtedly assist in creating interest, among the magnet wire users, in the possibilities and benefits of using magnet wires with superior conductor surfaces. Our own feeling is that:

1. There seems to be a lack of interest or a hesitancy in exploring this subject fully on the part of the magnet wire users generally in Canada that is contrary to the practise of similar users in the States.

2. As magnet wire producers, we would like to assume that this product is of such superior quality that improvement is not needed or necessary. However, knowing the limitations on surface quality that is inherent in the hot-rolled rod process, we feel that such an assumption would be erroneous.

The hot-rolling of copper rod as it is practised to-day, produces a product that is very attractive price-wise and of a quality that is perfectly satisfactory for the majority of end uses. However, the trade generally has realized the limitations of the process and through-

(*Please turn to page* 722)

Inhibitors vs. Accelerators

A SYMPOSIUM

Moderator: Allan B. Dove, Steel Company of Canada, Ltd., Lachine, Can.

Panel Members

W. Billingsley, Canadian Industries, Ltd., Montreal, Can.

J. T. Irwin, Poor and Company, Waukegan, Ill.

Alfred Douty, American Chemical Paint Co., Ambler, Pa.

The Theory and Use of Acid Inhibitors and Accelerators

by W. Billingsley

This symposium was held as a part of the technical program of the Montreal Regional Meeting on May 8, 1953. The presentations of the three panel members were followed by the questions from the floor and the answers to them. These will be published in the August issue.

Pickling inhibitors are agents which are added to a pickling solution to minimize corrosion.

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A friend of mine, D. L. Warrick, Timken Roller Bearing Company, Canton, Ohio, prefers this definition, "An agent that may be added to an acid pickling bath to diminish the attack of the acid on the metal areas from which the scale has been removed, without appreciably retarding the rate at which the acid removes scale or rust. The agent should also diminish the severity of hydrogen embrittlement."

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In recent years organic-type inhibitors have been universally used to accomplish these ends. Widely varied materials have been advocated, for example in the early days any available material or waste product was used such as tar, fats, rye flour, sour beer, beer yeast, sugar wastes, glue, gelatine and even urine. These substances more or less achieved satisfactory results, in that less base metal was dissolved and correspondingly less hydrogen evolved. In later years, synthetic products, for the most part related to organic dyes have been produced. Together with these synthetics, certain raw materials and by-products are now in use. For the information of chemists who may be present, it seems evident that acid inhibitors must consist of a hydrocarbon part attached to a polar or ionizable group. In general, they contain nitrogen, oxygen, sulphur or other elements in the fifth and sixth groups of the periodic table. Such compounds are amines, mercaptans, heterocyclic nitrogen compounds, substituted ureas and thioureas, sulphides, aldehydes, etc. The raw and waste products referred to previously, include sulphonation products of wood tar, coal tar, and asphaltum, waste sulphite, cellulose liquor or powder, wheat bran, sludge acid from oil refineries, waste animal materials and a host of others. Needless to say, these last-named products or materials, varying widely in their effectiveness and uniformity, have an economic advantage and are not necessarily inferior to synthetic inhibitors. Inhibitors may be truly soluble in pickling acid or may be colloidally dispersed, as would be the case with gelatine or glue.

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The actual mechanism of inhibitor action is not well understood. Some investigators believe that inhibitors are negative catalysts that are selective in action, retarding the reaction of acid on metal but not on scale. Various observers have stated that inhibitor action seems to be associated with an increase in the hydrogen overvoltage at the metal surface. A protective coating of hydrogen, maintained on the metal surface, helps to protect the metal from direct contact with the acid, thus diminishing the attack. Another theory is that a thin layer of inhibitor material is adsorbed or plated out on the surface of the metal. Many of the known organic inhibitor solutions are colloidal in nature, a fact which lends support to the possibility of adsorption.

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The principal advantages to be gained by using an inhibitor are, reduction in metal loss, saving of acid, prevention or minimizing of scrap losses from overpickling and decrease in blistering and hydrogen embrittlement. Disadvantages are a slight increase in pickling time, possibility of residual film, which may interfere with subsequent operations, and the additional cost of inhibitor.

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With regard to pickling procedures in the low carbon wire industry, there is a definite trend towards lower pickling temperatures, about 155° to 170° F. This

has resulted in economy in steam consumption and in better quality of the finished product. Where time and capacity permit, an acid concentration of 6 to 8% sulphuric acid, by weight, is advisable.

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However, when pickling cycles and capacity demand otherwise, it is customary to compensate for the decreased thermal activity by increasing the acid content to 10 or 12%.

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The use of muriatic acid at 10 to 12% by weight, operating at room temperature or slightly higher, seems to be the order of the day for high carbon wire pickling operations. In both of these operations, a suitable inhibitor should be used.

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Most of you are aware of the use of foaming agents in sulphuric acid pickling baths. Foamers are employed to blanket the surface of the pickling solution with a suds which traps and holds any fine spray of acid that otherwise would be carried into the atmosphere with the evolved hydrogen gas. The chief advantage of foaming agents, therefore, is to prevent pollution of the atmosphere by acid fumes. Confusion appears to exist in the minds of many, concerning the relation between inhibitors and foaming agents. Actually, they represent independent phenomena, although in many proprietary compounds they are co-existent. When a sufficient quantity of a good inhibitor is used, the evolution of hydrogen is so small that a foaming agent becomes virtually unnecessary.

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The use of accelerators in pickling baths has increased during the past several years. These chemicals may take the form of surface active agents down to common rock salt. Under certain conditions they are advantageous to the pickling operation but in my opinion, should be used with discretion.

Acid Pickling and Depolarizers

by J. T. Irwin

Acid pickling is a form of electrolytic corrosion, and in the process, hydrogen evolved tends to polarize the corrosion cells. Chemical compounds which increase the polarization are classed as inhibitors. The Corrosion Handbook lists over one hundred such compounds in the order of their effectiveness.

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By inference, chemical compounds which decrease polarization would be classed as "accelerators."

★ ★ ★

While the trend, in industrial pickling has been to increase polarization, the value of depolarization in the acid pickle bath has been recognized for some time. Continuous strip pickling is an example of depolarization at work in removing hot mill scale efficiently and economically.

★ ★ ★

High acid concentrations, temperatures over 200°F., and the agitation resulting from moving the strip through the tanks at speeds as high as 400 feet per minute, help remove scale rapidly. But as important as any factor is the depolarizing effect of dissolved oxygen. In rapidly moving solutions of sulfuric acid, the acid activity can be increased as much as three times over that of the same acid without the oxygen. That much is in the literature today.

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Working on the theory that since some degree of depolarization was helpful in continuous strip pickling, and that this type of pickling was efficient as well as economical, we developed some interesting chemical depolarizing compounds as acid additives.

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We wanted something cyclic in its action, and subject to concentration control.

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One of our first mistakes was in selecting one fast compound to be used in any type of pickling. In several cases this degree of acceleration was more than batch picklers could handle, without increasing handling equipment and manpower.

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Today, however, there are a series of compounds available for any degree of activity required, up to a hundred times that of normally inhibited baths. These compounds are cyclic in action and are the subject matter of pending patents here and in the States.

★ ★ ★

In speaking of inhibitors in the Corrosion Handbook, J. C. Warren, and G. C. Eldgredge, after discussing laboratory tests used to evaluate them, warn us that "only plant trials will give the final answer."

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We've had some interesting plant trials with accelerators and I'd like to quote briefly the results in three different fields.

★ ★ ★

First, in silicon steel pickling, "polarizing" additives have not proven satisfactory.

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One of the largest producers of electrical sheet told us that, and in the same breath said they had to cut down acid consumption somehow. Average figures on one set of tubs showed that they dumped at 3.7% acid and 6% iron, with a Baume reading of 23°. They used 603 gallons of acid a day to pickle 66 tons of steel.

★ ★ ★

They found that by using one

of our chemical depolarizers they could dump at 1½% acid and 8½% iron, with a Baume reading of 27°. They used 451 gallons of acid per day to pickle 88 tons of steel.

★ ★ ★

Normal acid consumption in the silicon steel department was over eight million pounds a year. They estimate conservatively, that they now save over two million pounds a year. They are now in their third year of operation with chemical depolarizers. One other major producer now has over a year's similar performance with chemical depolarizers.

★ ★ ★

In the hot dip galvanizing field shorter pickling times, cleaner steel, tighter coatings, and acid economy have resulted from using chemical depolarizers. One mill reports thirty per cent less acid per ton pickling heavy hot mill scale prior to galvanizing, as compared to previous inhibitor or "polarization" experience.

★ ★ ★

We have done quite a lot of field work in rod pickling. To start with, in one mill we did an excellent job with the one fast depolarizer originally selected for all types of pickling. I understand that acid consumption figures which we established have not yet been broken. At that time we had not developed our own non polarizing type foam blanket, and so retired gracefully from the field temporarily. Other test work in other mills was not satisfactory because the depolarization factor was too high to meet local handling problems and bad scale conditions.

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Learning by our mistakes, we have just completed a month's test run in one of the major mills using a compound with a lower and more suitable depolarization factor for this type of work. We also checked out our new non-polarizing foam blanket. Accounting figures show better than thirty per cent savings over previous "polarization" practice.

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Similar tests are under way in two more mills at the present time.

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To conclude, I would suggest that the concept of depolarization as a tool for more efficient and economical pickling, while not new, is worthy of investigation by you mill men who are concerned with costs, quality, and production.

★ ★ ★

Using the new series of depolarizing compounds, plant trials and production figures have proven highly provocative. Controlled depolarization may well be the key to better pickling practice.

Inhibitors and Adjuncts

by Alfred Douty

The experience of our firm with inhibitors goes back about 30 years. At the time of our entry into the field there was little accurate information about so-called pickling inhibitors available to the steel manufacturers. It is probable that almost as soon as sulphuric acid became available in sufficient quantity to allow its widespread use as a means of descaling steel, (which was around 1860), picklers began to add things to sulfuric acid baths to affect their action in one way or another.

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It must have been observed very early that the violence of attack of the acid on the steel was reduced in the presence of certain substances. Some substances produced foam on the bath; others seemed to give whiter appearing work, etc. At any rate by 1883 patents had been granted on additives for pickle baths. By 1923 the patent tide on inhibitors, restrainers, "pickle controls," etc. was on the flood, and to this day the waters continue to rise.

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I shall not here go into the mechanism of inhibitor action which has been treated in many scientific papers. In the thirty years of our experience, however, we have learned a few practical things. These things may be stated simply as follows:

(1) What we mean by an inhibitor
(2) What are the various reasons why people use them
(3) How to make reasonably persuasive evaluations of inhibitor substances in the laboratory and in the plant.

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We have no intention of discussing in detail in this introductory paper all phases of these matters. Suffice it to say that we can define what we mean by an inhibitor and we can assign numbers to inhibiting substances which represent their effectiveness under defined conditions of use.

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To begin with, let us define an inhibitor, for the purposes of this discussion, as a substance which, when added to an acid solution used in treating steel, reduces the rate at which the acid reacts with the steel. While it is realized that a measurement of such restraining effect under a single set of conditions may prove misleading, it is nevertheless true that the measurement yields a number which can be compared with other numbers obtained with other inhibitors under the same precisely controlled conditions.

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I am fully aware that no one such number is completely determinative of the practical value of an inhibitor. Assuming that we have chosen for test a set of conditions such as acid concentration, temperature, iron content, pickling time, etc., representing closely the commercial condition to be simulated, there still remain a variety of unanswered questions. For example:

(1) How well does the inhibitor retain

(*Please turn to page* 717)

Aluminum Sheathed Cables

by P. J. Croft, Chief Engineer
Canada Wire and Cable Company, Ltd.
Toronto, Ont., Canada

This paper was read at the Montreal Regional Meeting of The Wire Association on May 8, 1953. In it Mr. Croft describes the various cable sheaths available and describes the applications on which aluminum has been used successfully.

Introduction

The encasing of an insulated conductor or an assembly of such conductors within the confines of an exterior sheath or jacket performs a dual purpose, first as a barrier against the ingress of moisture or other influences deleterious to the cable insulation, and secondly as a mechanical protection against physical damage to the insulated conductors within. It is evident that the most satisfactory type of cable sheath will be one in which both these primary functions can be combined in the simplest and most straightforward manner.

Lead Sheaths

The moisture-proofing function of the sheath was the first consideration receiving the attention of cable engineers, and for a time perhaps the only consideration since the outstanding difficulty with cable insulations in the early years was concerned with its integrity in the presence of moisture.

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Today, cable sheaths are available either in metallic or non-metallic substances, and there seems to be an increase of interest in non-metallic sheathed cable. Sheaths of neoprene, P.V.C., and similar synthetic substances are excellent in conjunction with cable insulations which themselves offer some resistance to moisture, such as rubber or P.V.C. insulation. In those instances, however, in which the exclusion of moisture from the body of the insulation is a sine qua non, as with impregnated paper insulation, it is widely recognized that there is no moisture-barrier quite equal to a continuous, extruded metal sheath.

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From ancient historic times lead had been known as a long-lived and satisfactory material for containing and withholding water, and lead has in addition a number of sterling qualities from a manufacturing point of view. The principal advantage along these lines is the fact that it is relatively soft at all temperatures, becomes plastic at a conveniently low temperature, and at or about this temperature has a relatively long plastic range so that it is susceptible of extrusion in the form of a tube onto the core of an electrical cable.

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Since the invention of the hydraulic lead extrusion press by Francois Borel in Switzerland in the year 1879 lead has been the outstanding, and until relatively recently, virtually the only metallic substance for the sheathing of cables. It is expected that lead sheathed cables will enjoy a continuing field of usefulness based on the long life expectancy which they have established over the 50 or 60 years during which they have been used. Lead, however, has some notable shortcomings in the matter of tensile strength and resistance to creep which render it only fair from the standpoint of mechanical protection and it has become customary to reinforce lead sheathed cables with steel tapes or steel wire coverings, or alternatively to enclose such cables in steel conduits, concrete duct structures and other devices to give increased mechanical protection.

Sheaths of Aluminum etc.

This being the case, it is only natural that the attention of cable engineers has been turned to the possibility of using metals other than lead and giving superior mechanical protection for the overall sheaths of electrical cables. Virtually all other common temperatures are too high for contact with a cable core of material having suitable electrical characteristics and aluminum is the only metal so far offering promise in this direction. Even with aluminum, unless the metal is of ultra-high purity and correspondingly high priced, the temperature required for extrusion is inconveniently high and the plastic range regrettably short, so that the problem of the direct extrusion of aluminum on the cable cores is still far from completely solved.

The Swaging or Sinking Process

However, where no electrical cable core is present it is possible and is in fact now commonplace to extrude circular seamless aluminum tube or pipe in long continuous lengths. In 1947 an English company, Messrs. Johnson & Phillips Limited, placed in commercial operation a process invented by P. M. Hollingsworth for introducing long lengths of insulated cable cores into correspondingly long

lengths of somewhat over-size extruded aluminum pipe and sinking or swaging the aluminum tube down onto the electrical core in the form of a continuous seamless impervious aluminum sheath. The rights to this process have been taken up in Canada by the company with which the author has the honour to be associated, and aluminum sheathed cable manufactured by this process is in full production here in Toronto and considerable quantities have been supplied to electrical utilities and other users.

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At this point it would seem to be proper, especially for this particular audience, to digress briefly from the written script of my paper in order to deal very briefly with the history of aluminum sheathing for cables.

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It should first be pointed out that up to the present time the direct hot extrusion of any metal other than lead onto the core of a cable has met with very little commercial success. In the case of steel and copper the temperatures involved are of course far too high for close proximity to any of the organic materials normally used as cable insulation. Aluminum is the only metal which has offered any promise in this direction and aluminum sheathed cables made by direct hot extrusion have been produced only in experimental quantities and at unduly high cost, it having been necessary to make use of ultra-pure aluminum in order to obtain the necessary ductility and plastic range for the extrusion operation.

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At the present time aluminum sheathing for cables falls into one or other of two main groups of processors, there being variations between individual manufacturers in respect to both groups. The first may be called the draw down process in which a seamless extruded tube somewhat larger in diameter than the cable core is previously produced in long lengths by hot extrusion. The cable core is introduced into this tube after which cable core and tube are taken through a "sinking" or "swaging" die which has the effect of reducing the diameter of the tube to a nice fit over the cable core, the wall thickness of the tube not being reduced, but the length of the tube of course being increased in proportion to the reduction in diameter. The second group of processes involves the production of long lengths of aluminum in the form of a flattened strip. The strip is formed around the cable core and closed into a tube by welding. Generally speaking, it is necessary to protect the cable core from the heat of welding which involves some form of shoe or protective element between the inside of the formed-up tube and the cable core. This in turn means that the tube formed by welding up the strip must be somewhat larger in diameter than the core so that these processes are generally followed by a rolling down or similar process in order to bring the tube down to a nice fit over the cable core. The advantages of the former group of processes lie in the presence of the seamless extruded sheath which results, and in the fact that no hot processes are carried out at or near the insulated cable core. The advantage claimed for the formed up welded tube processes lies in the relatively long continuous lengths of cable which may be produced.

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Speaking before the Lead Industries Association in White Sulphur Springs, West Virginia, last month, Mr. Kenneth S. Wyatt, well known cable engineer of the Phelps Dodge Copper Products Corporation, drew interesting attention to the fact that the earliest use of aluminum sheathed cable known to him was in the equipping of the dirigible air ships Akron and Macon in 1932, in both of which lighter-than-air craft aluminum sheathed telephone cable was used in relatively short lengths due to the necessity for physical lightness. The obvious vulnerability of the dirigible balloon and the somewhat grisly ends to which most of them came has led to their disappearance from the scene, but the quality of lightness which led to the choice of aluminum sheathed cable in the equipping of these aircraft still remains one of the outstanding advantages of aluminum as a sheathing material for cables.

★ ★ ★

During the early years of the Second World War and immediately prior thereto, as Mr. Wyatt points out, the Oberspree Cable Works and other German manufacturers produced small quantities of aluminum sheathed communication cable chiefly by the tube-reduction process, although the most earnest of the German efforts were directed towards the production of sheath by direct hot extrusion. It was not until after the Second World War that large scale manufacture of aluminum sheathed cable was commenced, and it was Messrs. Johnson & Phillips in England who led the way by the draw-down process mentioned above. In this process seamless aluminum tubing in long lengths on reels is received at the cable plant, these tubes having been produced by hot extrusion from a commercially pure aluminum billet of electrical grade material. In the aluminum sheathing machine the cable is taken off the reel and laid out horizontally in the trough of the sheathing machine which is of very great length. The cable core, which is some 10 to 20% smaller than the inside diameter of the tube provided, is drawn up from another reel and into the tube until the leading end of the core and the tube are adjacent. The tube provided, however, is shorter than the cable core in approximately inverse proportion to their differences in diameter. The core and tube are pointed by means of a swaging head for introduction into a sinking die and by means of a capstan and takeup equipment the assembly is drawn through the swaging die which has the effect of cold sinking the tube down to a nice fit over the cable core. The sinking die has, of course, a somewhat different contour from a drawing die and the wall thickness of the tube is not reduced as in the case of a tube drawing operation, in fact the wall thickness of the finished sheath shows a slight increase over the wall thickness of the tube. The decrease in diameter of the tube is matched by the in-

crease in length and the length of the tube and of the core are of course chosen so that the end of the tube and the end of the core will arrive at the die at or about the same moment.

★ ★ ★

There are two principal limitations on the length of cable which may be sheathed in this manner. The first is the physical length of the sheathing machine which however is not itself limited by any basic consideration and may be made as long as economically or commercially desirable. In practice this machine is arranged to produce cable lengths of 1,000 to 1,200 ft. which is adequate for the very great majority of cable lengths called for in practice. The other principal limitation is the length of seamless extruded tube which may be produced from a single billet and this in turn is largely a matter of the size of the extrusion press equipment available at the Aluminum plant. At present, presses of about 5,000 tons capacity capable of extruding billets weighing some 650 lbs. are available in North America. Presses of about 7500 tons capacity producing billets of somewhat larger size are available in Great Britain. The 650 lbs. billet will produce tubes capable of sheathing about 1,000 ft. of 2″ cable or correspondingly smaller lengths of larger size cable. At the present time tubes extruded from multiple billets welded behind the die in the press are not used for the continuous sheathing of cables since the press stop area of the aluminum tube is at the moment regarded with suspicion. Intensive work, however, is in progress and is expected to lead to reliable results in the near future.

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At the present state of development, some 3,000 miles of aluminum sheathed cable have been produced in Great Britain, the great majority of it by Johnson & Phillips; some 500 miles in Germany, and a smaller quantity in North America, by the Canada Wire & Cable Company and by Phelps Dodge in the United States.

Field of Application of Aluminum Sheathed Cables

The proper field of application of aluminum sheathed cables includes all those applications in which the requirements of mechanical strength and resistance to shock and physical abuse would render lead sheathing unsuitable unless provided with external reinforcement in the form of steel wire or steel tape armouring; also all those applications in which internal pressure in the cable either intentionally applied for the purpose of ionization control or fortuitously present as in the case of oil-impregnated paper insulated cables operating under a high static head. Also for those applications in which economies may be achieved in utilizing the superior strength of aluminum sheathing for surface wiring circuits which would otherwise be included in rigid conduit or electro-metallic tubing; also for those applications in which weight-saving is a primary consideration. Let us deal first with the matter of weight-saving.

EQUIVALENT SIZES OF COPPER AND ALUMINUM CONDUCTOR CABLES WITH COMPARISON OF WEIGHTS

Cable Description Copper Conductors. Ratings based on 3 Loaded Cables per duct bank at 100% daily Load Factor. Ambient Temperature 20 deg C.	Equivalent Size Aluminum Conductor and Lead Sheath. (No Sheath Current)	Approx. Weight Copper Conductor and Lead Sheath	Approx. Weight Aluminum Conductor and Lead Sheath	Approx. Weight Copper Conductor and Aluminum Sheath	Approx. Weight Aluminum Conductor and Aluminum Sheath
Single Condr. 750 MCM P.I.L.C., 12 Kv Ungrounded. (710 A)	1,150 MCM	5,200 lbs	4,600 lbs	3,400 lbs	2,700 lbs
3-Condr. 500 MCM Sector P.I.L.C. 12 Kv Belted Ungrounded Neutral (360 A)	780 MCM	11,200 lbs	10,200 lbs	7,500 lbs	5,700 lbs
3-Condr. #2/0 (133,100 CM) Sector P.I.L.C. 12 Kv Belted Ungrounded Neutral (150 A)	198 MCM	5,100 lbs	5,300 lbs	3,200 lbs	2,500 lbs
Single Condr. 1,000 MCM P.I.L.C. 3 Kv Ungrounded (900 A)	1,600 MCM	5,600 lbs	6,000 lbs	3,750 lbs	3,500 lbs

Figure 1. * * * * * * * * * * * * * * * *

Fig. 1 shows a number of worked examples of copper conductor and aluminum conductor paper insulated cables of equal current carrying capacity when installed under identical conditions and also showing the comparison in weights of these cables. Additional columns show a comparison between the weights of these cables when sheathed with aluminum and it will at once be seen that the saving in weight when aluminum replaces lead in the sheath is more notable than when aluminum replaces copper in the conductor. These ratios of course will vary depending upon the particular make-up of the cable, but the general principle holds in all cases. A glance at the classical formula for current carrying capacity would indicate that the current carrying capacity of an aluminum sheathed cable should bear a relationship to that of a copper conductor cable of the same cross-sectional area in accordance with the square root of the conductivities of copper and aluminum, but since the aluminum conductor and in consequence the completed cable will be somewhat larger in diameter, its heat dissipation is somewhat more favourable and the total thermal resistance will thus be somewhat lower in a given set of conditions so that the exact relationship does not hold true.

★ ★ ★

Let us now look at Aluminum sheathing with particular reference to those applications in which internal pressure is an important operating condition to be met.

★ ★ ★

Cable insulated with paper tapes impregnated in petroleum compound and enclosed in a metallic sheath have proved themselves so satisfactory during almost a half century since they were first in-

troduced that this type of cable construction has come to be regarded as a standard and this type of cable is unquestionably in far greater use than any other type for general power distribution. Due to the intimate partnership played by the paper and its impregnating compound in providing a high grade of cable insulation, it is a cardinal requirement that a paper insulated cable be securely potheaded at its ends, rendering the sheath and its terminations a closely sealed vessel in which the compound can be retained against all internal and external influences. Implicit in this type of cable construction is the necessity to regard it as a hydraulic system since the petroleum impregnating compounds with which the paper tapes are impregnated nevertheless behave in accordance with the laws of hydraulics. From time to time a problem arises in connection with the installation of a cable for a long vertical extension i.e. where some portion of the cable is at a very much higher elevation than some other portions of the cable. In such applications an impregnated paper insulated cable will develop an internal pressure at the lowest portion of the cable theoretically equal to the absolute pressure corresponding to the head of oil between the lowest and highest portions of the cable. This is theoretically opposed by the pressure of atmosphere working from the outside provided the ends of the cable are critically sealed. From an electrostatic point of view the internal pressure is all to the good, but it becomes a requirement of the enclosing sheath that this must have sufficient strength and creep resistance to avoid distention and subsequent bursting. Ordinary lead sheaths can be depended upon to give good service when so designed and applied that the hoop stress, i.e. the tensile stress, tending to burst the sheath corresponding to pressure within does not exceed approximately 125 lbs. per sq. in. For various types of lead alloys such as copper bearing lead, this may be increased to some extent so that for many ordinary applications the pure lead sheath or alloy lead sheath is adequate for cables having moderate differences of elevation throughout the run.

* * *

Fig. 2 shows a family of curves giving the relationship between internal pressure and hoop stress for cables of various diameters and sheath thicknesses. For aluminum sheath cable since the tensile strength of aluminum is at least eight times greater than that of lead, and the creep resistance immeasurably greater, the hoop stress may be allowed to rise as high as 1000 lbs. per sq. in. or more so that very much longer vertical extensions of oil impregnated paper insulated cable may be installed with unreinforced sheath if the sheath be of aluminum rather than lead.

* * *

Fig. 3 shows a related curve, in which the formula connecting internal pressure and hoop stress has been rearranged, and the ratio of wall thickness to cable diameters are given as a function of internal pressure, for hoop stresses of 125 p. s. i. (corresponding to lead sheathing) and 1000 p. s. i. (aluminum sheathing). Good results may also be achieved along these lines by means of a lead sheath suitably reinforced with steel tape armouring, but it will usually be found that considerable costs savings may be realized by the use of an unreinforced aluminum sheath rather than a steel tape reinforced lead sheath. Excellent examples of the use of the superior tensile strength of aluminum sheath where internal pressures are a factor can be found in high tension cable engineering. Two principal groups of methods have developed whereby it has

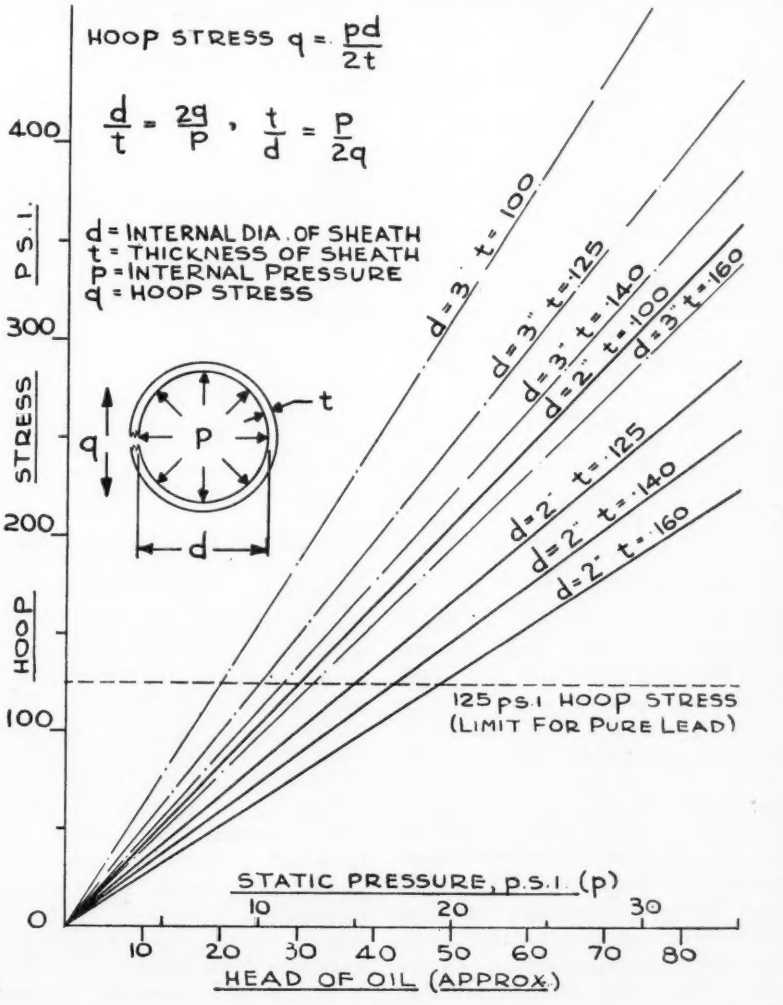


Figure 2.

been possible to extend oil impregnated paper insulation into higher and higher voltage design. First, the so-called void-free principle in which as in the case of Emanueli type oil-filled cable the insulation is kept free from ionizable voids by supplying it through an internal channel with a low viscosity type of oil fed from external reservoirs which supply and receive oil to and from the cable with cycles of heating under load. And the second principle in which the paper insulation impregnated with a compound of high viscosity is kept under a moderately high pressure (about 200 lbs. per sq. in.) either externally or internally from a separate medium such as gas or oil, i.e. separate from the actual insulating compound. In either case (except in so-called pipe type cables) the envelope of the cable becomes a pressure vessel. In the case of an Emanueli type oil-filled cable installed in hilly territory it becomes necessary to provide a hydraulic stop in the oil system with a separate set of oil reservoirs in order to limit the hydraulic head on any section of the cable. Since this hydraulic head must be limited to 125 to 150 lbs. per sq. in. hoop stress in the case of an unreinforced lead sheath, but may be permitted to go as high as 1000 lbs. per sq. in. or more with an aluminum sheath, it follows in a general way that Emanueli type oil-filled cable may be installed in hilly territory with many fewer hydraulic stops if aluminum sheathing is used in place of lead. An installation has recently been completed in Montreal of 120,000 volt Emanueli type oil-filled cable in which it has been possible to eliminate hydraulic stops entirely by means of the use of aluminum sheath. In the case of high pressure oil or gas-filled cables of the self-contained internal pressure type, (as distinct from the pipe type) it is seldom, if ever, possible to contain the required pressures of about 200 lbs. per sq. in. in an unreinforced lead sheath. An interesting cable installation, however, is now in process of manufacture and installation will soon be commenced of a self-contained high pressure gas-filled cable for 69,000 volts to be used in the City of Vancouver. In this instance the 3-condr. separately sheathed principle which I have already described will be used, but in this instance each conductor will contain an internal gas channel with nitrogen pressure at 200 lbs. per sq. in. and will be enclosed in an unreinforced aluminum sheathed cable.

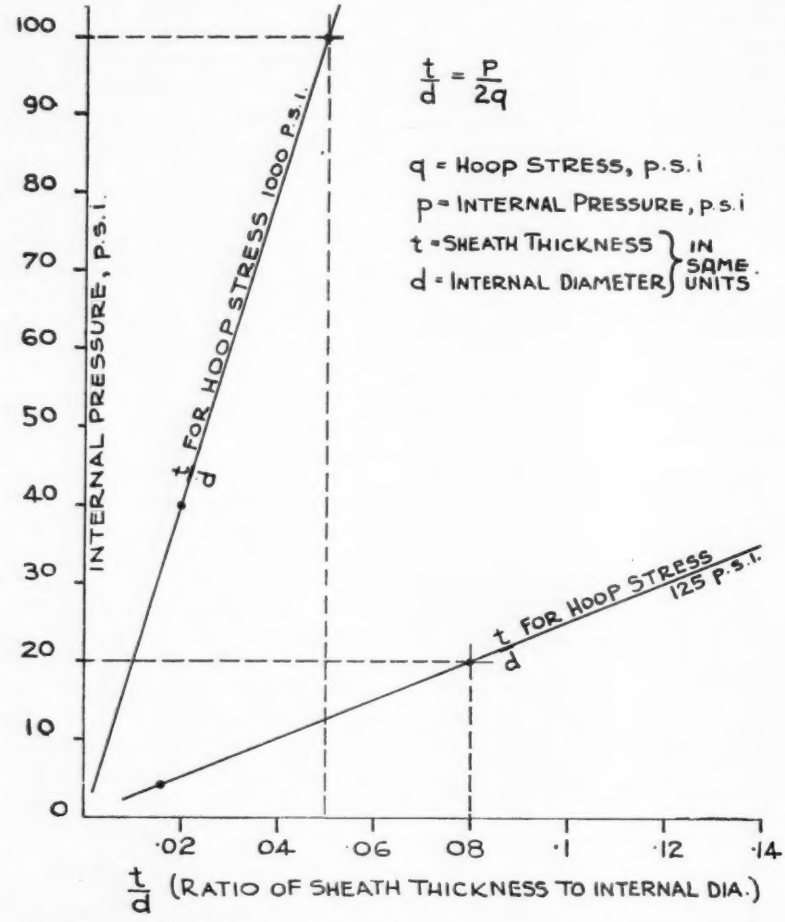


Figure 3.

Universal Application of Aluminum Sheathing

Since the method of applying the aluminum sheath is a "cold" process, there are few, if any, technical restrictions to the types of cable core which may be so enclosed. Indeed it is a feature of aluminum sheathed cables that any type of standard or special insulation may be employed in the core over which the aluminum sheath is applied. In the power cable field rubber insulated, varnished cambric insulated or impregnated paper insulated cables have an exactly similar construction, whether they be sheathed with lead or aluminum, the only difference being in the sheathing material itself and in the characteristics of lighter weight and greater tensile strength which go with it. In the building cable field, cables having single or multiple cores of standard rubber insulated or thermoplastic insulated types can be sheathed with aluminum and supported along building surfaces in exactly the same manner as rigid conduit or electro-metallic tubing or for that matter flexible armoured cables Types AC and ACL. In such make-ups, the individual conductors are insulated in accordance with standard practice and are in fact individually wires of fully approved types. This has been the practice which has been successfully established in Great Britain, where many hundreds of miles of such circuiting

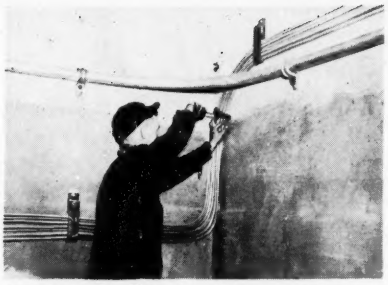
material has been supplied and installed since its inception in 1947. This is the practice which, subject to the approval of the individual inspectors and subject, we trust, to the ultimate blanket approval on the part of the Code authorities, it is proposed to pursue also in this country.

Handling Characteristics of Aluminum Sheathed Cable

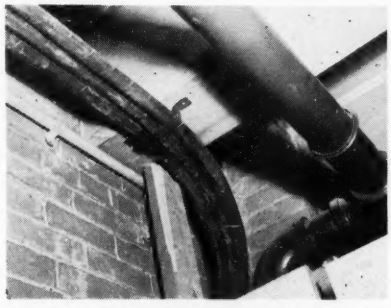
Contrary to the assumptions of some who have had no experience with aluminum sheathed cable, this material presents no difficulties in handling and installation. It is true a little stiffer than lead sheathed cable of the same size and electrical characteristics which additional stiffness is useful in conjunction with the lighter weight of the aluminum sheathed material, since it makes possible the spacing out of supports on walls and racks to almost twice the distance which would be used for lead sheathed cable. On the other hand, the stiffness is not of such a magnitude as to render the cable in any way unmanageable and indeed the cable is shipped on reels but little larger than those normally used for corresponding lead sheathed cables. The cables may be unreeled without difficulty and the smaller sizes of cables are readily formed and trained into supports with the hand. For the larger sizes of cable, simple bending and forming fixtures similar to those normally used for tubing can be applied.

Corrosion

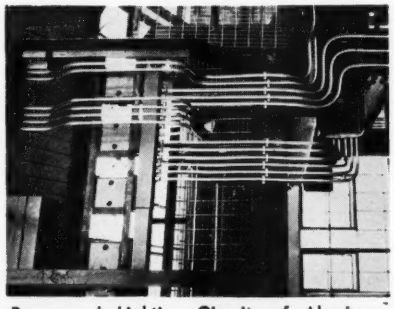
When lead sheathed cables with suitable mechanical reinforcing are direct buried in the earth, the asphalted jute bedding provided for the outer steel armour also acts as an effective deterrent against corrosive substances in the soil. With lead sheathed cables in underground ducts each case is customarily handled on its own merits, the lead sheath being provided with anti-corrosion protection in some instances and allowed to lie bare in the ducts in others. There is a long record of experience with lead sheathed cables on which to base such procedures. In the case



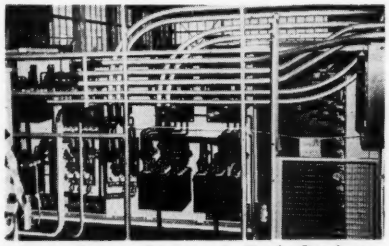
Installing 13 KV P.I. Aluminum Sheathed Power Cable and 600 Volt PVC Insulated Aluminum Sheathed Control Circuits on a Concrete Wall. * * * * *



Single-Conductor 600,000 CM, RI Aluminum Sheathed Cables, with Neoprene Overall Jackets. * * * * * * *

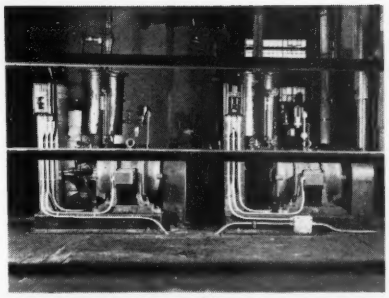


Power and Lighting Circuits of Aluminum Sheathed Rubber Insulated Cable. * *

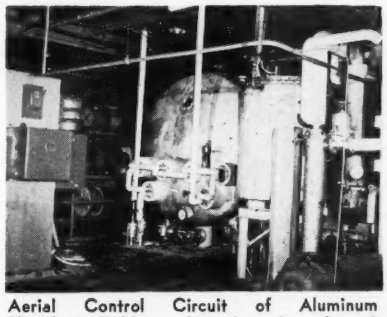


Heavy Power Circuit of Single-Conductor and Three-Conductor Aluminum Sheathed Cable. * * * * * * *

Watertight and Non-watertight Connectors on a Short Sample of Aluminum Sheathed Cable. * * * * * * *



Aluminum Sheathed Cables Connecting Pump Motors and Controls, where Vibration and Oil Exposure are Factors. * * * *



Aerial Control Circuit of Aluminum Sheathed Cable. * * * * *

of aluminum sheathed cables which are relatively newcomers on the scene, some form of protective outer jacket is, for the time being at least, recommended on all such cables to be buried in the earth or installed underground in ducts. For aluminum sheathed cables to be run overhead as surface wiring circuits in industrial buildings etc., no protective coating is considered necessary, except in situations where the atmosphere is known to be polluted with fumes of a nature corrosive to aluminum.

★ ★ ★

In a general way, aluminum is known to be more vigorously attacked by alkaline agencies than by acidic agencies. This, however, can be regarded only as a general statement as there may be numerous instances to the contrary. The following list gives a general summary of the corrosion characteristics of aluminum sheathed cable.

Summary of Known Corrosion Data on Commercially Pure Aluminum with Reference to Commonly Encountered Substances

(A) Completely Unaffected by:
Boric acid, acetic acid, carbolic acid,

(*Please turn to page* 725)

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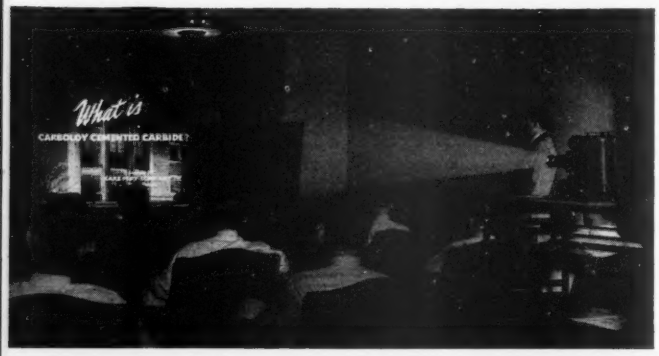

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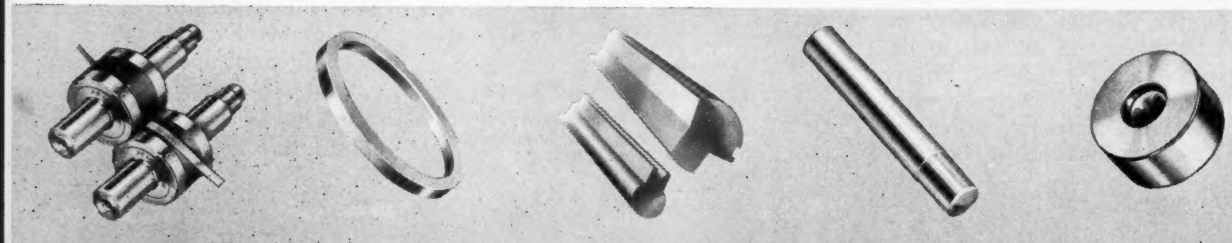

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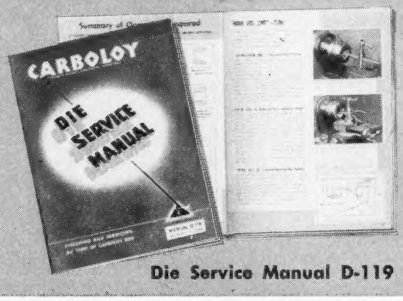
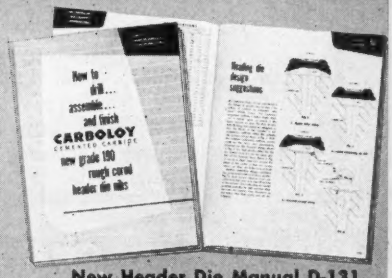


Die Service Manual D-119



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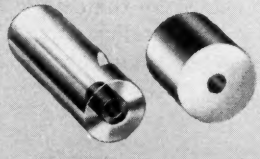
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★ ★ ★

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T. J. Tracey, Canadian General Electric Co., Ltd., Montreal, Canada.

W. Walker, Phillips Electrical Works, Ltd., Montreal, Canada.

The Semi-Annual Meeting of the Board of Directors

The meeting was called to order at 10:00 A. M. on May 7, 1953, President L. C. Crewe, Jr., presiding. There being a majority of the Board of Directors present, the meeting was declared in order.

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The Executive Secretary then read the minutes of the previous meeting, which were duly ordered accepted and adopted as read.

★ ★ ★

The Secretary-Treasurer then presented the semi-annual report from October 1, 1952 to April 1st, 1953.

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On motion duly made and seconded the report was ordered adopted as read.

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The Secretary then read the minutes of the Executive Committee Meeting held at Trenton in April. No conclusions were approved in connection with this.

★ ★ ★

W. L. Wells reported that the convention program for the Non-Ferrous Division was proceeding satisfactorily.

★ ★ ★

The Secretary read the written report from J. R. Garey, stating that the work of the Non-Ferrous Stranding Specification Committee had been completed on the project in hand. On motion duly made and seconded a vote of thanks was extended to this committee with the instructions that the Chairman of the committee be advised that the committee remain as a standing committee, but inactive, unless something came up demanding its attention.

★ ★ ★

Mr. Brown reported that the matter of the Cold Heading section was dormant. A motion made by Mr. Dove and duly seconded to bring this matter up again at the next Directors' Meeting to learn what action, if any, had been taken up with the members desiring the formation of such a group.

★ ★ ★

Tom M. Girdler reported by letter, that the plans for the Annual Convention in Chicago were complete with the exception of arrangement for a Non-Ferrous plant visit.

★ ★ ★

J. E. Flood made a satisfactory report to the effect that they had a complete program for the Insulated Wire group for the Convention.

★ ★ ★

W. L. Wells reported that the the Bare Wire group was in the process of completing definite arrangements for a paper on the "Properzi Method of Continuous Casting of Aluminum". After a discussion on the desirability of an insulated wire plant visitation, Mr. Brown was instructed to contact Western Electric Company regarding a trip to their Hawthorne Plant.

★ ★ ★

Fred M. Crapo suggested that Dr. Comstock of Titanium Alloy Manufacturing Company be invited to give a paper at the next Convention and Mr. Wells reported that he would approach him immediately.

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G. J. Hubbard reported that a smoker-dinner would probably be presented at approximately the same cost as the 1952 dinner and that the matter was well in hand.

★ ★ ★

Allan B. Dove made a report for the Medal Award Committee with the following recommendations: the Medal Award for 1952 to Mr. Howard J. Godfrey of John A. Roebling's Sons Corporation; an Honorable Mention for his ferrous paper to Jere Y. Heisler; and an Honorable Mention for their non-ferrous paper to E. P. Hall and R. D. Peck, co-authors. Upon a motion made by Mr. Dove and seconded by Mr. Whitney, the Directors voted that the awards be made as recommended by the committee. In this connection, Mr. Brown brought up the question that Mr. Peck was not a member of The Association and it was de-

cided that in such a case, two certificates should be issued to co-authors provided someone of the author's company was a member of the Association.

★ ★ ★

Mr. Wells outlined plans for the Non-Ferrous Meeting to be held at Waterbury on September 24th. After a discussion it was agreed that a registration fee of $7.00 should be charged. This fee to include registration, bus transportation, cocktail party and dinner.

★ ★ ★

He stated that their committee did not want to handle the financial matters of the meeting, but preferred to have this done through the office of the Wire Association.

★ ★ ★

K. H. Davis reported that the San Francisco Meeting would be held on Friday, June 12th, with Headquarters at the Sir Francis Drake Hotel in San Francisco, as a one day meeting. The meeting is to consist of a plant visit to the Pittsburg Wire Mill and Wire Rope Plant of Columbia, a division of the U. S. Steel Corp., a luncheon, then return to the hotel, a cocktail party at which those present would buy their own drinks, to be followed by a dinner with a guest speaker and two technical papers. The program was approved.

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Mr. Crewe then read a letter from Mrs. John A. Moritz acknowledging receipt of the Memorial Book, authorized by the Directors and sent to her in January, 1952.

★ ★ ★

The next business was the election of the new member of the Executive Committee to succeed Mr. Wells. Upon motion duly made and seconded, Benoit J. Sirois was elected to serve until the expiration of Mr. Wells' term in November, 1953.

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Mr. Crewe brought up the question of preparing a set of rules and suggestions to govern the handling of Regional Meetings by local committees.

Mr. Brown read a preliminary draft of such suggestions and was directed to complete the work and supply each member of Regional Meeting committees with a copy at the time of his appointment as a member of such a committee.

★ ★ ★

Mr. Crewe then stated that Roger M. Scott of the Morgan Construction Company of Worcester, Mass., had submitted a plan for a two day Regional Meeting to be held at Worcester, Mass., for both the Ferrous and Non-Ferrous Divisions in the spring of 1954.

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Upon motion made by Mr. Whitney, duly seconded by Mr. Dove, this meeting was approved and authorized.

★ ★ ★

Upon motion duly made and seconded, the meeting place for the 1955 Annual Meeting was designated for Chicago at the La Salle Hotel.

★ ★ ★

Mr. Crapo then suggested that since Kenneth B. Lewis was one of the Charter Members who founded this Association, that the Secretary be instructed to have a resolution prepared and sent to Mrs. Lewis, similar to the one sent to Mrs. Moritz. On motion by Mr. Crapo and seconded by Mr. Dove it was so ordered.

★ ★ ★

The President then made the following committee appointments:

Nominating Committee for Directors:
Fred M. Crapo, Chairman
James E. Flood
Richard E. Brown

Nominating Committee for Officers:
Carl Johnson, Chairman
John L. Sanderson
Robert Peterson
Richard E. Brown, Ex-Officio

Nominating Committee for Executive Committee:
John L. Sanderson, Chairman
Dave Schmidt
Richard E. Brown

★ ★ ★

Mr. Crapo said that he would be very glad to receive suggestions for a Mordica Memorial Lecturer for 1954.

On motion made by Mr. Sirois and duly seconded, a vote of thanks was extended to Mr. Dove and his co-workers on the preparation and handling of the Montreal Meeting.

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There being no further business to come before the meeting, it was adjourned at 12:15 o'clock.

★ ★ ★

Following the business meeting of the board, the directors entertained the committee and the program participants at a luncheon in the Brittany Room.

Plant Inspection Trips

Busses left the hotel at 1:15 P. M. on May 7th, with 135 men for a tour of the Noranda Copper and Brass mills on the east side. This proved interesting and took approximately an hour. At 3:00 P. M. the group was taken acrosstown to the west side to visit the new plant of Canadian Tube and Steel Company, where the latest and most modern types of high carbon processing equipment was observed. What with the sizes of the plants and the extensive walking required to get around the two plants, most guests were glad to settle down in the busses at 5:15 P. M. for the return trip.

Evening Activities

The men who had come to Montreal for the meeting brought their ladies with them to a pleasant cocktail hour preceding the banquet. Music for the occasion was furnished by a "barbershop quartet".

★ ★ ★

Mr. Dove held a reception, attended by about 30 people to extend the welcome of the Wire Association to Mayor Houde, Mr. Rumble and Mr. J. Allen of the Bank of Montreal, who were guests at the banquet.

★ ★ ★

The dinner in Sheraton Hall was colorful and pleasing, given a rousing start by toasts to Her Majesty the Queen and to the United States of America by Allan B. Dove, who served as toastmaster.

(*Please turn to page* 726)

NOW'S THE TIME

TO MAKE ARRANGEMENTS TO ATTEND THE ANNUAL CONVENTION OF THE WIRE ASSOCIATION

The Time: November 9th through the 12th, 1953.

The Place: La Salle Hotel, Chicago, Illinois

Hi, Ed let's swap a few ideas
Sure thing- that's what we're here for
Boy- what a great list of speakers
You said it- and look at the wonderful menu too
I never met so many helpful fellows
Yessir! It sure looks like a lot of fun ahead, too
Call for all smart business men
PROGRAM

DON'T MISS THE CONVENTION... *it's got everything!*

This Convention will present to wire men the finest program ever. There will be 18 papers, plus a symposium on descaling processes. Three papers will jointly interest both ferrous and non-ferrous men, five will cover non-ferrous bare wire and wire product processing, four will be concerned with insulated wire and the balance will treat of ferrous wire and wire product problems. ***Don't miss these excellent papers!***

Plans have been concluded for a colorful Annual Luncheon, where awards for outstanding papers will be presented, the interesting Mordica Memorial Lecture given and, in the evening, the justly famous Stag Smoker-Dinner will be held.

BESIDES THESE FEATURES, TWO PLANT INSPECTION TRIPS ARE BEING ARRANGED AND THERE WILL BE THE ANNUAL MEETING OF WIRE ASSOCIATION MEMBERS. REPORTS ON ACTIVITIES WILL BE MADE AND CURRENT QUESTIONS VOTED UPON. EVERY MEMBER IS STRONGLY URGED TO BE PRESENT AT THIS MEETING AND PARTICIPATE IN IT.

Next month a detailed program will be published.

But arrange NOW to be in Chicago in November!

THE WIRE ASSOCIATION

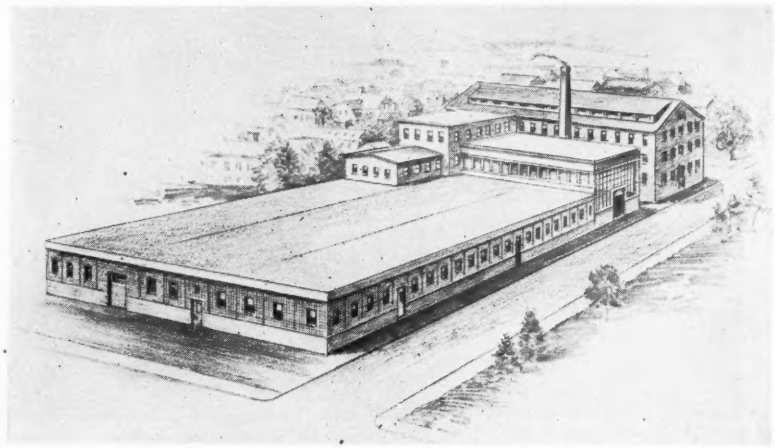
Richard E. Brown, *Executive Secretary*

453 MAIN STREET **STAMFORD, CONN.**

Revitalization of Old New England Wire Machinery Concern

by Edmund D. Sickels, Editor
Wire and Wire Products
Stamford, Conn.

One often hears that only in New England is change resisted. While here and there that may be true, it is hardly fair to generalize from a very limited number of particular instances. Industrial New England is in the main alert and progressive, whatever tendency to maintain the status quo having been jolted out of its collective system by a couple of world wars.



The new machine shop with older buildings at rear. Doorway at left opens to receive trucks in unloading room that is closed off from plant. Overhead equipment handles heavy parts or machines. Corresponding shipping room doorway may be seen at right at other end of shop. * * * * * * * * * * * * * *

Take the case of the venerable and respected New England Butt Company in Providence, Rhode Island. This company, now in its 111th year of continuous operation, was doing a fine business at the close of World War II, but showing something less than a profit for its efforts. It was at this juncture that, in 1945, the services of John A. Wilson were solicited. He accepted the challenge and soon became the company's fourth chief executive.

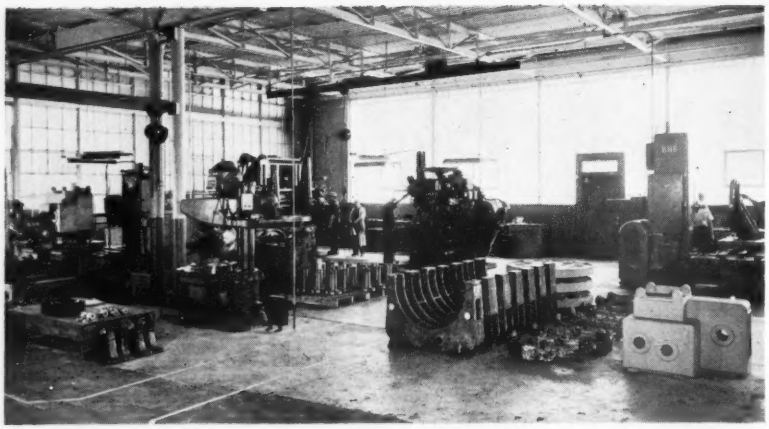
The basis of the business was a foundry. When the enterprise was started by Nicholas A. Fenner in 1842, it was to make cast iron hinges for doors, gates and so forth. As the business prospered, the variety of products expanded, and the company turned out flat irons, waffle irons, hitching posts, cast iron railings, locks, door stops and numerous other cast iron items. Around the time of the Civil War, because it offered a means of keeping the foundry busy, the making of braiding machines for the textile industry was started. The original product, however, cast iron hinges—called "butts" — provided the company with its distinguishing cognomen. Prior to 1842, these butts all had been imported from England.

★ ★ ★

While the company first made braiders in 1865, they did not come into the wire industry until 1888. In 1880 Edison had given the world the incandescent light that was to require so much electric wire and wiring. In 1882 the first commercial central station in the United States had been opened in New York City. The stage was set. Pacing the electric wire and cable industry's rapid development, "Butt" engineers started designing and building different types of machines, until they finally were able to offer complete lines of braiders, stranders, cabling and closing machines, bunchers, taping heads and the accessories associated with such equipment.

★ ★ ★

The business grew up in the very heart of Providence and from time to time new wings or additional stories were added to existing buildings. Since these usually extended operations and were made without reference to work flow, what Mr. Wilson immediately discovered was that work in process was being shifted up and down from one floor to another several times with considerable loss of time and energy and at great handling cost. Stocks were not properly cataloged, inventories were sketchy, tools were for the most part obsolete, machines produced were being hand-fitted in assembly. What to do? He decided to eliminate the captive foundry in the city, where objection to its smoke, dust and dirt was becoming more vocal and where means to keep it busy had constantly to be sought. It was dismantled, the equipment sold and the foundry building razed.



A corner of the machine shop showing horizontal and vertical boring mills and a radial drill

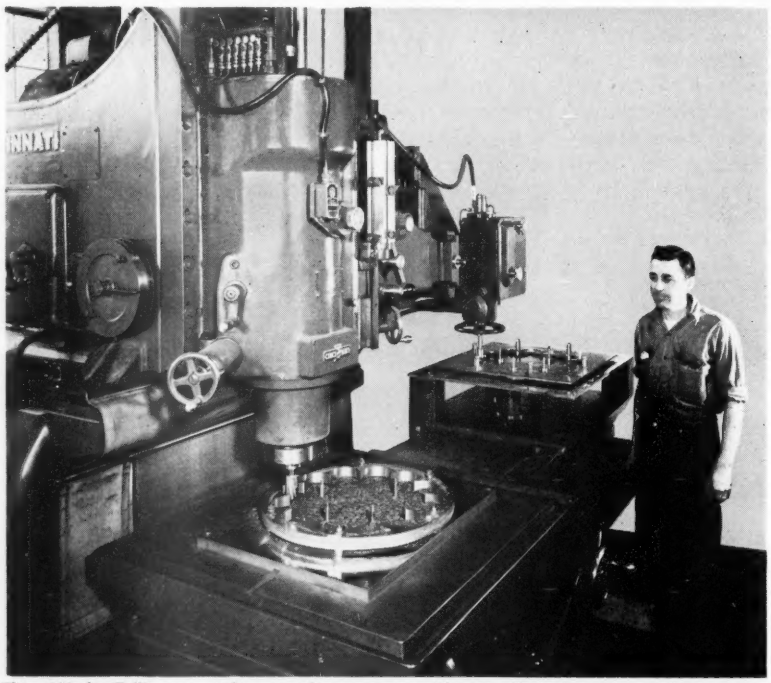
In its place a spacious, light and clean machine shop was erected and equipped with the latest machine tools including horizontal and vertical boring mills, gear cutters, planers, milling machines, lathes and radial drills. Plant layout was a basic question. Each piece of equipment was so located that all work in process flowed progressively from the first operation to final assembly and from receiving rooms at the rear of the building to the front shipping platform.

★ ★ ★

Simultaneously there was begun a complete redesigning of equipment produced for the wire and textile industries. Where gears had been cast, they are now **cut** to close tolerances from blanks for increased quietness, balance and strength. Where braider top plates had been laboriously ground by hand and ultimately hand fitted in the assembly room, a smart new Cincinnati "Hydro Tel," equipped with carbide cutters, using master templates, rapidly produces large stocks of parts exactly duplicating the master templates.

★ ★ ★

This and other modern production techniques have given all new New England Butt machines complete interchangeability of parts. Formerly, when a machine required overhauling, it or its operating parts had to be sent back to the plant for re-fitting. Now, accurately machined parts can be ordered by number and installed in the machine upon receipt, with assurance that they will fit and function.



This "Hydro-Tel" accurately reproduces parts with complicated contours from master templates. * * * * * * * * * * * * *

Looking down one side of machine shop. Plenty of space and light with good placement of machines with respect to work flow. * * * * * * * * *

A running inventory system has been set up and stocks of all parts are maintained to assure customers prompt delivery of machines and replacement parts. Centrally located in the machine shop is a new tool room, with a large supply of carbide cutting tools, gauges, etc.,—also modern equipment to maintain them in top-notch condition.

★ ★ ★

The Company maintains its own pattern shop and pattern storage system even though all castings are purchased since they can be obtained better and cheaper than

(*Please turn to page* 728)

Government Wire Production Information

Third Round of Aluminum Expansion Started

Signing of the first agreement in the third round of aluminum expansion was announced in May by Edmund F. Mansure, Administrator of General Services. The kick-off agreement is with the Harvey Machine Co., Inc., of Torrance, Calif., and calls for construction of facilities with a capacity to produce 54,000 short tons of primary aluminum a year.

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The new facilities will be at or near The Dalles, Oregon, and will consist of a two-potline aluminum reduction plant and an alumina plant with a capacity adequate to supply the reduction plant for full operation.

★ ★ ★

Under the agreement, a letter of intent to be followed by a formal contract, the Government has an option to buy, at market price, the total output of the new facilities for a period of five years. The Government, in turn, agrees to buy at market any metal offered to it by the company which the company does not sell or use.

★ ★ ★

As under the other expansion contracts, the Government must notify the company in advance of how much of the company's total output it intends to purchase. Two-thirds of the total output, less any amount which the Government elects to buy, must then be offered to so-called non-integrated users.

★ ★ ★

After five years, the company must offer 25 per cent of its total output to non-integrated users and continue to do so for 15 years. Non-integrated users are aluminum fabricators who do not themselves produce primary aluminum. There are about 17,000 of these.

★ ★ ★

All told, the Government is seeking, in the new expansion program, additional production of 200,000 tons a year. Two other firms—Olin Industries, Inc., of New York, N. Y., and The Wheland Co., of Chattanooga, Tenn., have been granted tax amortization certificates by the Office of Defense Mobilization, but as yet have not come to agreements with GSA.

Brass and Wire Mills Propose Industry Study by Two Task Groups

Appointment of two task groups to study the problems of post-attack planning for the brass mill and the wire and cable mill industries, was recommended to the National Production Authority, at a joint meeting of the advisory com-

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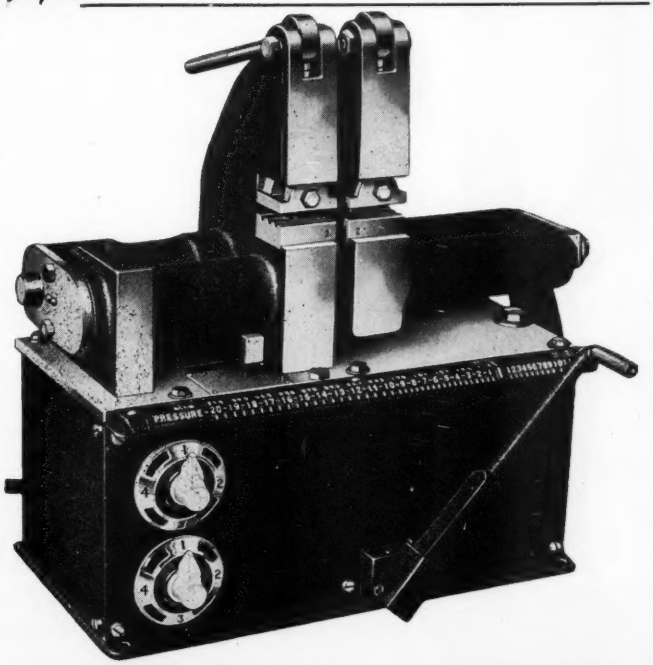
Welding capacity .080" to .375" diameter STEEL wire

The Model T-L Welder which is a self-contained unit suitable for various types of Butt welding, is equipped with individual hand clamps, and a single control lever for the spacing operations, applying the upset spring tension, and contacting the welding switch.

This unit can be supplied for either bench mounting, overhead crane, or mounted on 4-wheel truck.



MICRO PRODUCTS COMPANY

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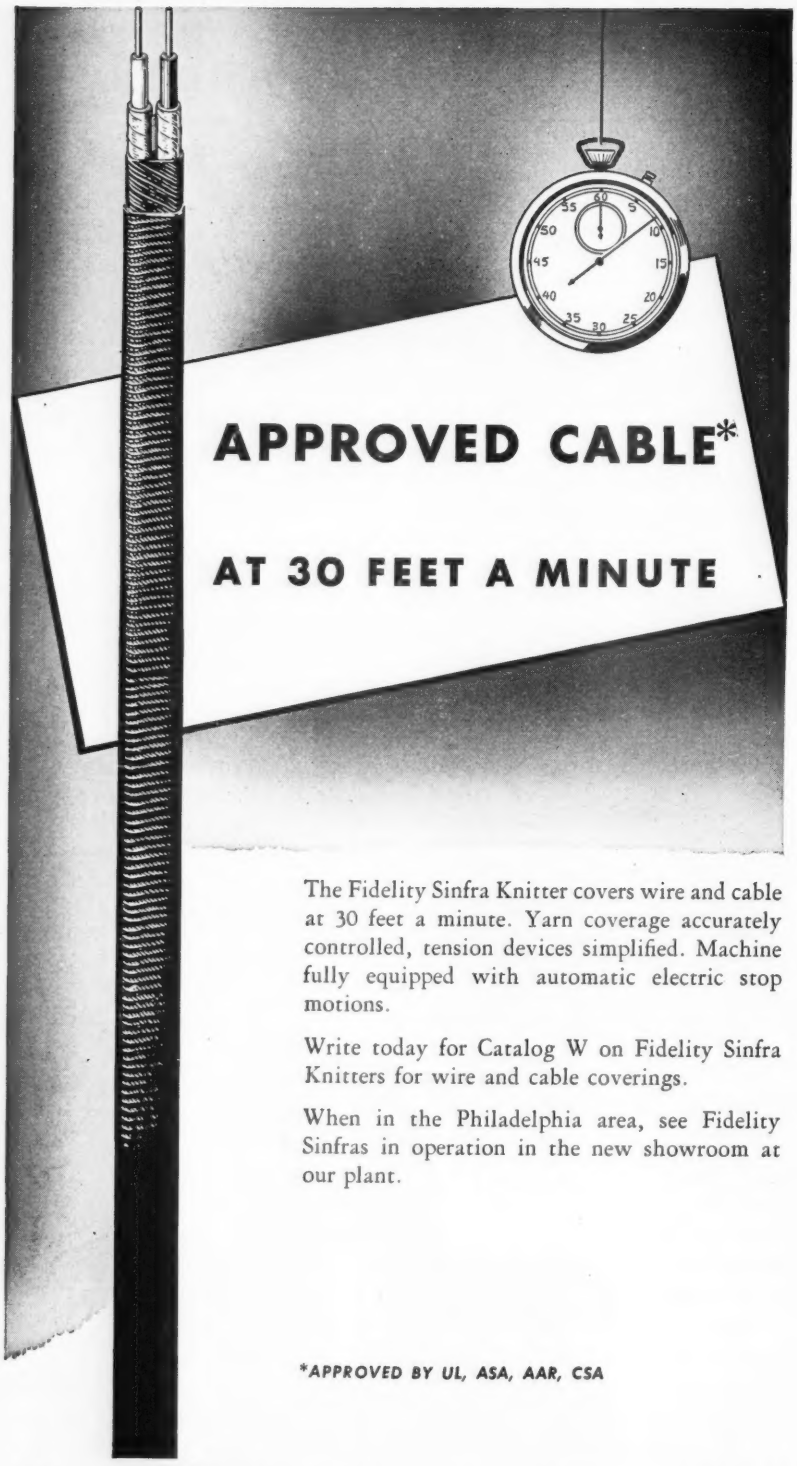

The Fidelity Sinfra Knitter covers wire and cable at 30 feet a minute. Yarn coverage accurately controlled, tension devices simplified. Machine fully equipped with automatic electric stop motions.

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mittees representing the two industries in May.

★ ★ ★

The task groups will be assigned the job of determining those areas affecting the two industries which can most profitably be examined and determining the method to be used in making the examination. The task forces will also review and collect the studies to be made and eventually report to the full committees.

★ ★ ★

Government spokesmen reviewed for the advisory committees a course of study involving possible preparations for resumption of production, preventative measures, reconstruction, logistics, and other related matters. It was emphasized that the effectiveness of planning for post-attack production will depend primarily on the initiative and resourcefulness of industry, but the government can and should advise industry as to the most vital and critical problems, and cooperate with industry in those areas where governmental action is necessary.

★ ★ ★

Members of the Brass Mill IAC said that, because of the difficulty of meeting shipping dates for certain of their orders, a product lead time for the industry should be increased from the present 45-day maximum. NPA officials said this request would be given immediate consideration.

★ ★ ★

Joseph F. Miller, director of NPA's Copper Division, presided at the meeting.

New Copper and Moly Sources To Be Opened

Copper and molybdenum mining properties known as the Mineral Hill Group and the Plumed Knight Group in the Pima Mining District, Pima County, Arizona, will be developed and improved under a contract announced by the Defense Materials Procurement Agency.

★ ★ ★

The contract is with the Banner Mining Company, Tucson, Arizona, and calls for the production of 12,-

960,000 pounds of refined copper over a three-year period. The project, under negotiation since last Fall, is a result of an exploration contract between the company and DMPA.

★ ★ ★

Production is expected to begin May 1, 1954. The company will produce copper concentrates and will contract with a refiner for the production of electrolytic copper.

★ ★ ★

The Government will buy the refined copper at a price of 31 cents per pound, f.o.b. middle western markets, and has an option at the market price on all molybdenum produced. It is expected that some tungsten also will be produced as a by-product.

★ ★ ★

To assist the company in carrying through the project, DMPA will advance the company up to $473,665, repayable with interest over a period of four and a half years. The company will spend $90,000 of its own funds on the project.

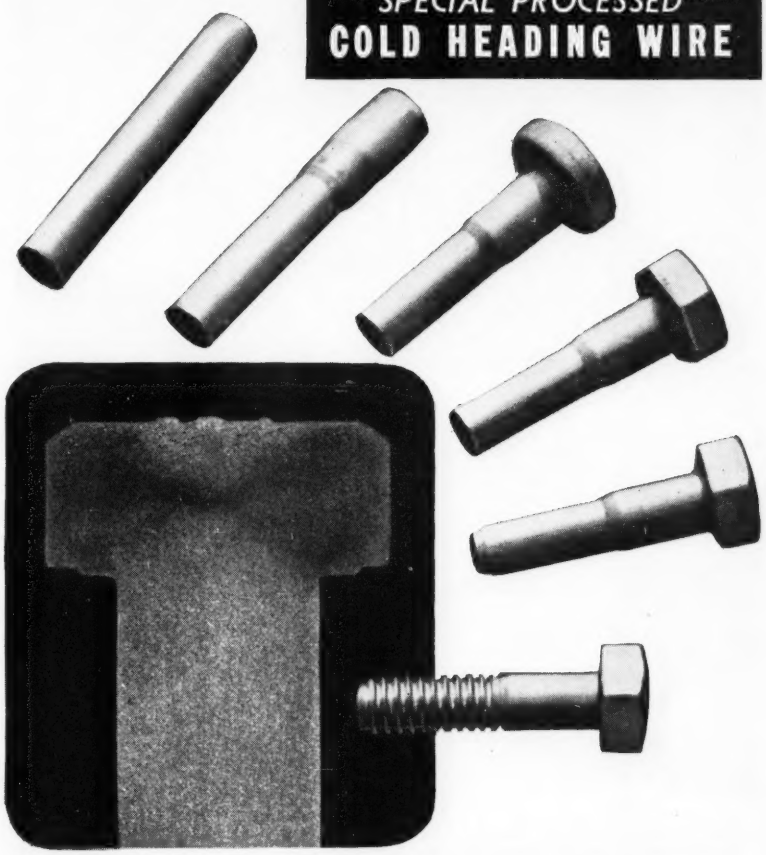
Government Contracts to Buy Nickel and Copper from Inco.

The International Nickel Company of Canada, Limited has announced the signing of a contract under which the United States Government has purchased for quick delivery a total of 120,000,000 pounds of metallic nickel and 100,000,000 pounds of electrolytic copper. The contract is with the Defense Materials Procurement Agency.

★ ★ ★

Deliveries under the contract will start this December. They are made feasible, according to Dr. John F. Thompson, Chairman of the Board of Inco, as the result of an entirely new project in the Sudbury District of Ontario which permits additional production of 2,000,000 pounds per month over Inco's current peak nickel production capacity. This is made possible by the completion in recent months of certain mining and metallurgical developments cli-

You get UNIFORMITY from start to finish with KEYSTONE
"SPECIAL PROCESSED"
COLD HEADING WIRE



When you use Keystone "Special Processed" Cold Heading Wire, you get uniform response every step of the way through forming, trimming, threading and final heat treatment.

Uniform, strength-giving grain flow characteristics are clearly indicated in the above macrograph of a high-strength cap screw made from Keystone "Special Processed" C1035 Cold Heading Wire. The long, continuous fibres tell the "inside story" of efficient cold heading which results in longer die life, lower production costs and finished products of the highest quality.

INDUSTRIAL WIRE SPECIALISTS

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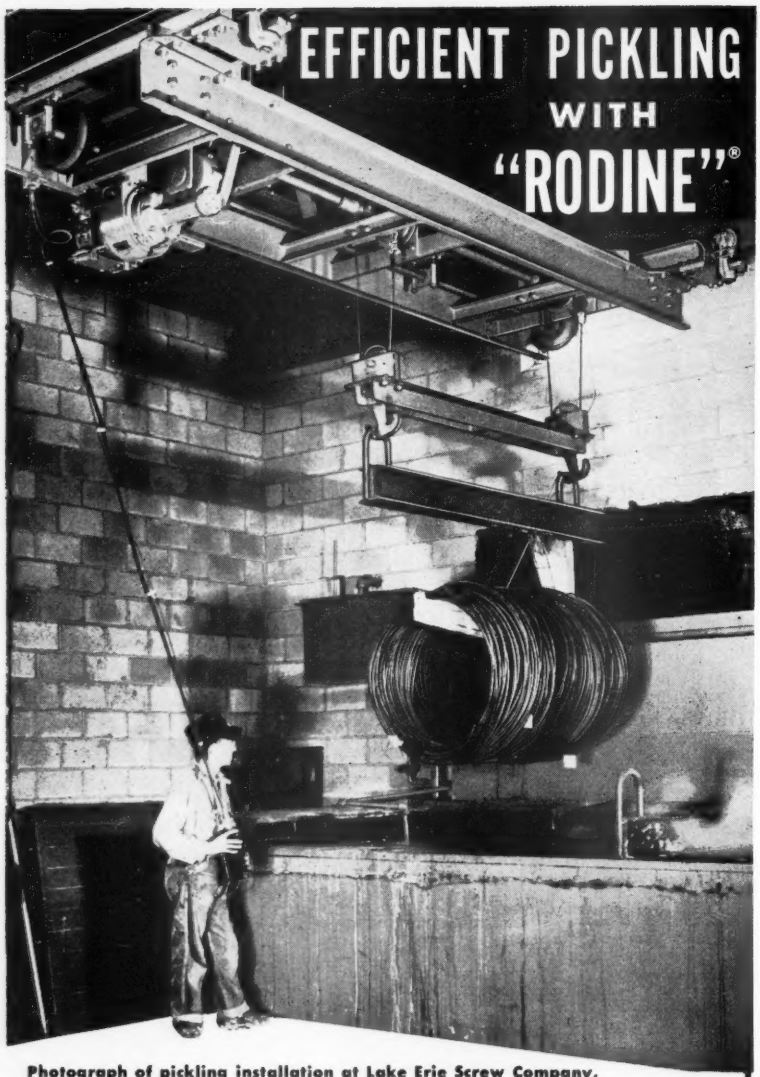

Photograph of pickling installation at Lake Erie Screw Company, by courtesy of The American Monorail Company, Cleveland, Ohio.

Rod and wire are pickled clean in "Rodine"-inhibited acid without waste of either acid or metal. Breakage in drawing, from acid brittleness, is minimized.

Wire and rod, pickled with "Rodine", as compared with less effective inhibition, are larger in diameter, and when drawn to the finished gauge the coils are longer and correspondingly heavier.

"Rodine" more than pays for itself in savings of acid and metal.

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maxing years of planning and research, and of the rapid advance in the company's underground mining expansion program toward which it has devoted the major part of its $150,000,000 capital expenditures made with its own funds since early in World War II.

Metal Cleaning Bibliographical Abstracts 1842-1951

These Bibliographical Abstracts are intended to make the published data on metal cleaning readily available to the many persons concerned with the production, finishing, and maintenance of metal products. This very important publication is a result of the intensive efforts of Jay C. Harris of Monsanto Chemical Company in collecting, arranging, and indexing over 1000 annotated references to the literature on metal cleaning. Material on metal cleaning was originally presented in 1949 as Special Technical Publication No. 90, followed by a supplement issued in 1950. This new publication combines all of the references from the 1949 and 1950 editions in addition to several hundred new ones, arranged chronologically, and brings up to date the coverage of metal cleaning for all kinds of metal and by most types of processes. The abstracts have been thoroughly indexed in the following four ways: Subject Index, Author Index, Specification Index, and Patent Index.

★ ★ ★

Copies of this 136-page publication can be obtained from Headquarters of the American Society for Testing Materials, 1916 Race Street, Philadelphia 3, Pa. at $4.25 each, in heavy paper cover.

Eighth Instrument Exhibit Increases Show Space

The National Instrument Exhibit has increased its exhibit space from the 27,000 sq. ft. which it occupied in 1952 to 34,000 sq. ft. for the 1953 Exhibit in Chicago. In spite of this increase, all space has been sold.

★ ★ ★

This Eighth National Instrument Show will present industry with the opportunity to survey the broad field of instrumentation.

★ ★ ★

Co-operating with the Instrument Society of America in presenting the technical sessions are the American Institute of Electrical Engineers, Instruments and Measuring Committee; the American Institute of Physics; the American Society of Mechanical Engineers, Industrial Instruments and Regulators Division; the Institute of Radio Engineers, Professional Group on Instrumentation; and the Scientific Apparatus Makers' Association.

★ ★ ★

The attendance at the Exhibit, which runs from September 21 to 25, 1953, at the Sherman Hotel in Chicago, is expected to reach 15,000.

Symposium on Fatigue with Emphasis on Statistical Approach—II

Measurements made to determine the physical properties of materials usually exhibit more or less variation in the results obtained with different specimens. Sometimes, the variations are small and therefore do not interfere with the interpretation of the data. Often, if experimental results vary to such an extent that uncertainty exists as to the value of the property under study, then attention is directed to refinements in the measurement technique and to better sampling procedures. If the material is not homogeneous, this fact may be of prime importance.

★ ★ ★

The papers in this Symposium indicate that the authors have given special attention to the variation associated with their material and to their measurements. In this respect these papers add their weight to a developing trend in experimental investigations. The example set by the papers in this Symposium should induce other workers to give adequate consid-

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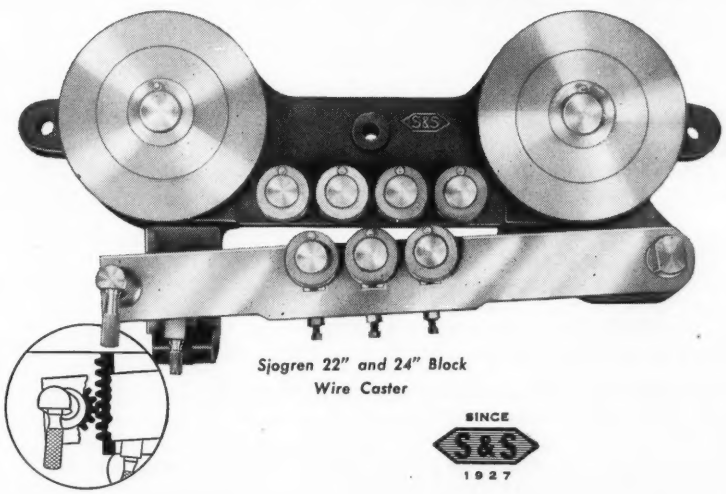
Smaller Sjogren Killers for the wire gauges of .005" up are available from stock in the 8", 12" and 16" block sizes; either clockwise or counter-clockwise rotation.



Sjogren 22" and 24" Block Wire Caster

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An Open Letter to WIRE MANUFACTURERS

Gentlemen:

Whenever you sell non-metallic sheathed cable, armored cable, or building wire to an electrical contractor, the first thing he looks for is the Underwriters' label. That label tells him that the electrical, moisture-resistant, flame-proofing, and other similarly important requirements have been met. But when the contractor actually begins to install the wire, he is then more concerned with its workability during installation:

Is it sticky in coils or on reels and spools?
Does the finish flake off when the wire is bent or pulled through joists?
Does it mark up walls?
Does it make workmen's hands unduly dirty?
And above all--does it cost the contractor overtime?

The Underwriters' label can't tell him these things; he finds them out by experience. And if experience provides the wrong answers, then your wire --as good a product as it is in itself--gets a bad name. Avoid such complications by making these checks:

Are your present saturants and finishes the most suitable materials for your products and methods of application?
Are you misapplying a saturant? ...using one designed for cotton on glass braid, for instance?
Are you getting all that you are paying for?

If you are not obtaining satisfactory performance from your present saturants and finishes, please write to us. We maintain a highly-trained technical staff which devotes its time to perfecting paints, varnishes, and saturants to meet particular requirements. At no obligation, we will be happy to run a series of tests and then make specific and impartial recommendations as to the materials and methods best suited to your own situation.

Cordially,

E M Paschall

President

EMP:GC

Solar Compounds Corporation
Solar Varnish Corporation
The Originator of Wire Color Solutions
1213 WEST BLANCKE STREET • LINDEN, N. J.

eration to the statistical aspects of their data.

★ ★ ★

These papers were presented at the Symposium during the 50th Anniversary Meeting of the American Society for Testing Materials held in New York City in 1952, and represent a continuation of the subject of statistical aspects of fatigue, Part I having been presented in March of 1952.

★ ★ ★

Copies of this 96-page Symposium can be obtained from Headquarters of the American Society for Testing Materials, 1916 Race Street, Philadelphia 3, Pa. at **$2.00** each, in heavy paper cover.

Bakelite Announces Expansion Plans at Press Gathering

On May 6th Bakelite Company, a division of Union Carbide and Carbon Corporation, played host to the press. The program included a visit to their Bound Brook, N. J., plant at which the resin's processing, testing and forming into products was shown and demonstrated, followed by a luncheon at the Far Hills Inn.

★ ★ ★

Members of the organization who had contributed to the development of polyethylene were introduced and the group was addressed by three top-ranking military men. These speakers all stressed the fact that the development work of private enterprise was of inestimable value to the Services and that they leaned heavily on industries, such as Bakelite, to satisfy their needs for the new and better products constantly required.

★ ★ ★

The principal speaker of the day was Bakelite's chief executive, **H. S. Bunn,** who told of the introduction of polyethylene to this country, of its rapid expansion and improvement in quantity and quality, of its ever downward price trend, of their plans for further expansion and who gave an optimistic word picture of the future of this versatile resin and its probable impact on our economy.

★ ★ ★

Among the interesting facts brought out was that in the short space of ten years polyethylene has become one of the most important plastic materials available. Until the end of World War II, polyethylene was not available for civilian use. Since then, in less than eight years, production and sales of this material have increased by 12½ times. It has enjoyed the most rapid rate of growth of any of the six major plastics sold in the United States during that period. The number of new applications in the postwar world has grown and continues to grow at a geometric rate. Its rapid growth and expanding market prompted the polyethylene expansion program planned.

★ ★ ★

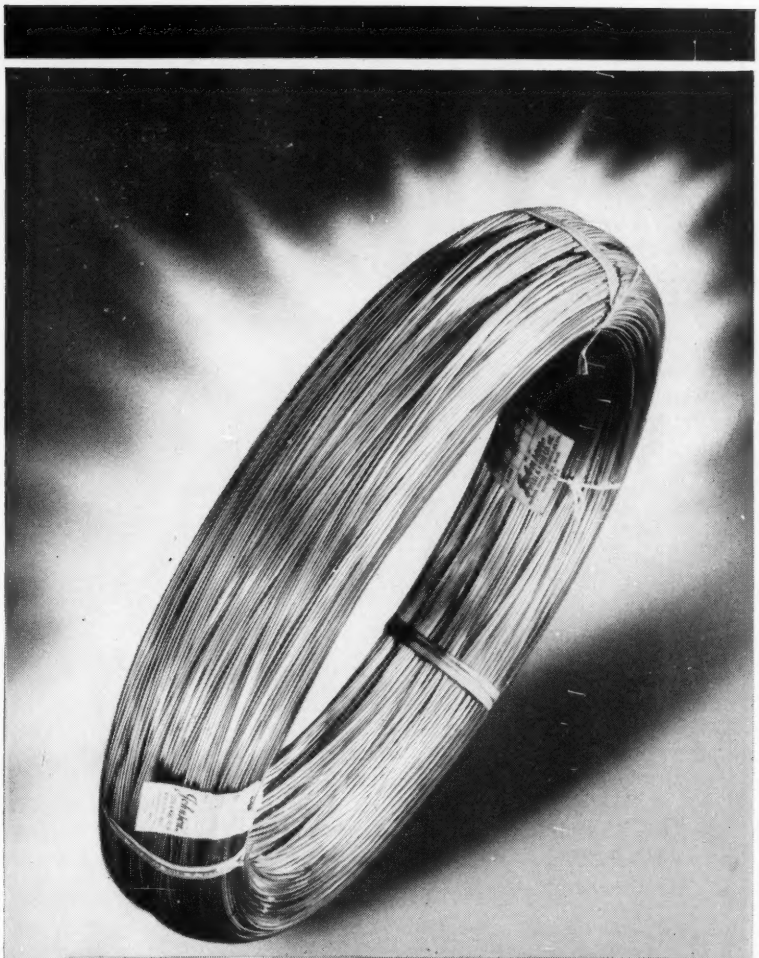
This program will increase the production of Bakelite polyethylene by about 400 per cent in three years. By 1955 the annual supply of polyethylene resins marketed by Bakelite Company alone will be twenty-five times greater than the 10,000,000 pounds produced and sold in 1945, just ten years before. The 250,000,000 pounds of resins Bakelite plans to sell in 1955 is twice the amount of polyethylene produced in the United States last year.

★ ★ ★

Three new plants to supply this quadrupled production capacity by early 1955 are to be built and operated by Carbide and Carbon Chemicals Company. Each new plant will have a production capacity of about 60,000,000 pounds per year or more. These plants make a system that stretches across the United States from one coast to the other. Two new plants will be located in Texas and another in California. The original plant, which began production in April 1943, is at South Charleston, W. Va. All four plants are near natural gas wells or major oil refineries from which they draw their basic raw materials.

★ ★ ★

The plant at Texas City, near Galveston, will be the first of the three to begin operation. It is expected to start producing about August of this year. The rated



High Quality High Carbon Wires

In investing money, the amount of interest you want should depend on whether you want to eat well or sleep well.

We have a large investment in Johnson plant and equipment, but that does not disturb our slumbers and our appetite is normal—all because we know that this investment yields well in the production of the highest quality Music Wire—"the wire of a thousand uses"—precision drawn and finished with a gleam that is the wire maker's dream.

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New Data Available on . . .

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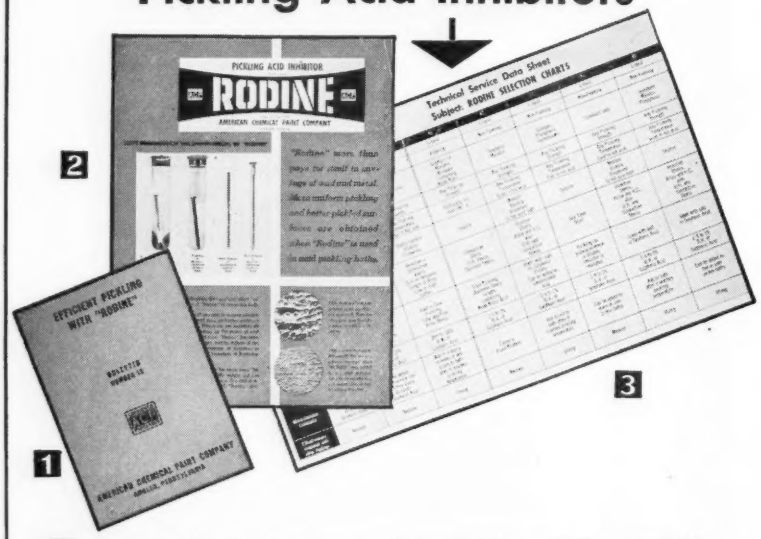
Pickling Acid Inhibitors



1 The standard reference work on pickling, "Efficient Pickling With RODINE" — Bulletin Number 13 — is now available in a new, revised edition.

2 This new 4-page general descriptive folder presents essential information on "Rodine" pickling acid inhibitors.

3 The recently revised "RODINE SELECTION CHART" gives characteristics of and uses for typical "Rodines" used with sulfuric and muriatic acids. Technical Service Data Sheet No. 13-1-1-4.

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City ..... State .....

capacity of this plant is about 64,000,000 pounds of polyethylene a year.

★ ★ ★

The second Texas plant, located near Seadrift, will go into operation by the middle of 1954 with a production capacity of about 60,000,000 pounds of polyethylene a year.

★ ★ ★

The California plant will be the first to manufacture polyethylene on the Pacific Coast. It is to be located at Torrance, and will begin production sometime in early 1955. This plant is rated at 60,000,000 pounds yearly capacity.

★ ★ ★

At South Charleston under this expansion program, production capacity has been increased to about 72 million pounds per year. New plant capacity has been installed at South Charleston since production began in 1943, due to increasing demand. In 1948 construction began on a new unit there which eventually added 30,000,000 pounds of polyethylene annually to the national supply. At the same time new engineering features and higher chemical conversion rates have made the South Charleston units six times as productive as they were in 1943.

★ ★ ★

Following the luncheon, spectacular demonstrations were staged, including the release of approximately 100 pillow balloons, such as are used to carry messages behind the Iron Curtain; the launching of a skyhook balloon used by the Navy for upper air research; the laying of pipe underground for farm water, aerial tow target practice; dropping of glass and polyethylene carboys from a helicopter; laying of assault telephone wire by soldiers, by truck and by plane; and demonstrations of a new recoilless heavy rifle using plastic liners to keep the powder dry.

★ ★ ★

All demonstrations involved the use of polyethylene, with a detachment of Signal Corps men from Monmouth going through these paces involving military personnel. The entire program was most convincing as to the role polyethylene is playing in the wire and other industries.

Outstanding Personalities of the Wire Industry

Tinnon Named Sales Manager At Drawalloy

William M. Tinnon, a native of Joliet, Illinois, has been named Sales Manager of the **Drawalloy Corporation,** York, Pennsylvania, according to an announcement by E. J. Brady, President of Drawalloy.

★ ★ ★

Mr. Tinnon was graduated from Rensselaer Polytechnic Institute in 1942 with the degree of BMetE, and thereafter served for four years in the U. S. Navy as a Lieutenant USNR. After his release from Naval service, he was associated with Bridgeport Brass Company as a research assistant, and with the Crucible Steel Company in a sales capacity.

★ ★ ★

He became associated with Drawalloy Corporation in September 1952. The company manufactures stainless steel, tool steel, special alloy, and automatic welding wire.

William M. Tinnon. * * * *

Carboloy Men Given Awards

Three members of the **Carboloy Department of General Electric Company** here have received G.E.'s highest award for outstanding employee achievement.

★ ★ ★

Charles A. Coffin awards were made to: **Otto Hittenberger,** general foreman; **Ernest A. Hughes,** supervisor-electrical maintenance; and **Perry D. Weiser,** application engineer. A fourth, **Francis W. Pierson,** methods equipment specialist, received honorable mention.

★ ★ ★

The awards were presented by K. R. Beardslee, general manager, in the Detroit plant. Mr. Hittenberger's award was for his contribution in the field of diamond wheels in carbide grinding. Mr. Weiser was cited for his application of cemented carbides to percussive drilling bits, and Mr.

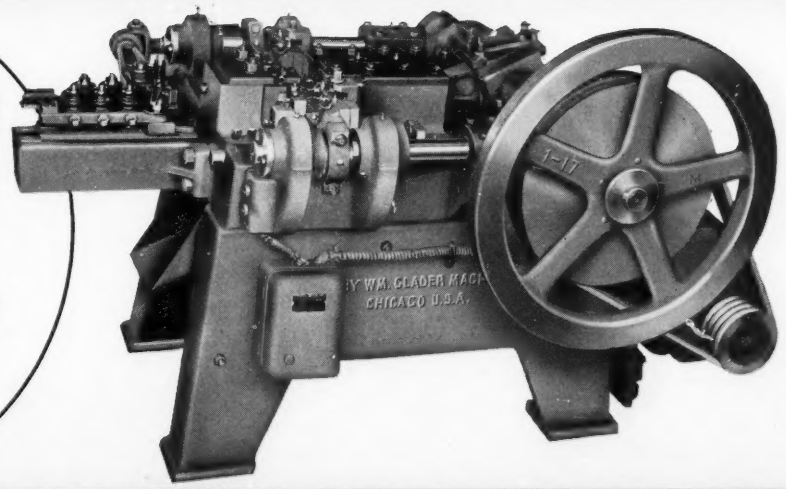
GLADER

HIGH SPEED WIRE NAIL MACHINES

HIGH TONNAGE OUTPUT—LOW MAINTENANCE COST

You can take care of increased production schedules and better product demands with these machines of established reputation.

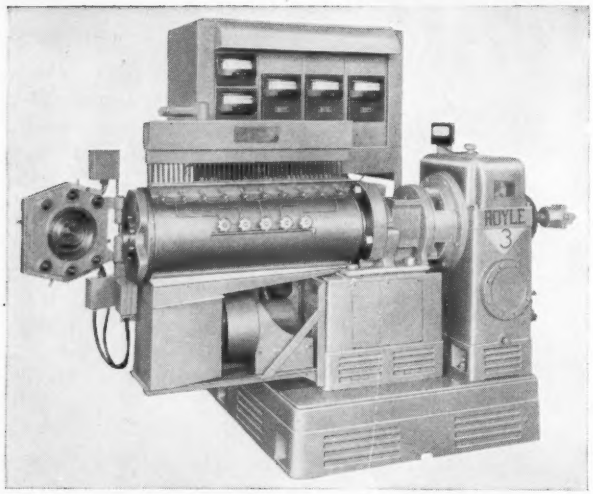
For 55 years GLADER MACHINES have been giving HIGH QUALITY, LOW COST nail production.



Wm. Glader Machine Works 210 N. Racine Avenue Chicago 7, Illinois

Export Dept.: 122 E. 42nd Street, New York 17, N. Y.

FASTEST HEATING FASTEST COOLING



Here are some of the time-tested, money-saving reasons more and more plants are standardizing with Royle Spirod* Extruders for processes requiring maximum flexibility in controlled temperatures — constantly maintained and accurately zoned:

- **Extra heavy walled cast steel cylinders that will not warp. No joints to leak when pressures are high or crevices to collect burned compound that would cause contamination.**
- **Heavy duty large diameter heating elements, that can be used with 440 volts without step-down transformers, provide radiant heat to cylinders and heads.**
- **Any heating element may be removed and replaced without disturbing other elements or wiring.**
- **A cooling system with ten times the capacity of conventional designs can be modulated through its entire temperature range without drastic changes. Ample cooling for all compounds at maximum speeds.**

No. 3 Royle Spirod Extruder. Completely insulated and equipped for evaporative cooling.

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Yes, it's the exclusive MPS *heavy duty thickened-section rims* that assure maximum strength and rigidity throughout the reel heads. Flange run-out and straightening expenses are eliminated by this patented MPS development. DURA-CURL rims are now standard on all MPS wire drawing, annealing, and stranding spools and reels. We invite your inquiries — let us tell you more about Dura-Curl rims.

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Hughes was singled out for his work with high temperature refractory furnaces used in sintering carbides.

The honorable mention was in the field of carbide grinding machines.

Pittsburgh Steel Advances Sales Executive

Appointment of **J. A. Hague** to the position of Assistant General Manager of Sales for **Pittsburgh Steel Company** has been announced by Allison R. Maxwell, Jr., Vice President—Sales.

★ ★ ★

J. A. Hague

E. C. Van Syckle

Also announced were: (1) Appointment of **E. C. Van Syckle** to the position of Manager, Rod and Manufacturers Wire Sales. (2) Appointment of **B. R. Hagelbarger** to replace Mr. Hague as District Sales Manager in the Cleveland District. (3) Appointment of **W. E. Shutt** to the post of Assistant District Sales Manager in Cleveland.

★ ★ ★

In his new position, Mr. Hague will be responsible for the sale of Wire Rods, Manufacturers Wire, Merchant Trade Wire Products, and Chain Link Fence. He succeeds N. J. Froelich, who has resigned.

★ ★ ★

Mr. Hague, 52, was born in Pittsburgh and attended Duquesne University. He brings to his new position experience of 32 years in steel sales. He started with Pittsburgh Steel Company in 1921. In 1922, he left to enter the Sales Department of Bethlehem Steel Company, where he advanced to take charge of wire product sales in the Cleveland District. He rejoined Pittsburgh Steel Company in 1936 to become District Sales Manager of the Cleveland Office, which handles sales of Pittsburgh Steel products in the territory of Ohio, Indiana, Kentucky and Tennessee. He continued in that post until his present appointment.

★ ★ ★

Mr. Van Syckle, 36, was born in Lakewood, Ohio, and attended business college. He joined Pittsburgh Steel Company, in May, 1938, at the Cleveland District Sales Office. He advanced to the position of Office Manager in 1942 and was a salesman, specializing in rod and wire products. In 1950, he was transferred to the General Office in Pittsburgh and appointed Assistant Manager, Merchant Trade Product Sales. He has been made a product manager with the title of Manager, Rod and Manufacturers Wire Sales.

★ ★ ★

Mr. Hagelbarger, 46, brings to his new position of District Sales Manager in Cleveland a total of 25 years experience in steel. Born in

WIRE SPOOLS, ALL-STEEL, LITHOGRAPHED

Ends and traverses may be shipped separately and assembled easily in your plant on a hand, foot, or power press.
5" and 6½" diameter ends with 1-15/16" diameter traverses.
10½" diameter ends with 3½" diameter traverses.
Traverse lengths up to 12".

J. L. CLARK MANUFACTURING CO.
600 23rd AVENUE • ROCKFORD, ILLINOIS

Akron, Ohio, he attended Kent State University. He joined Pittsburgh Steel Company in 1942 as a Development Engineer — Alloy Sales, being located in the General Office. In 1947 he became a Salesman, working out of the Detroit District Sales Office. In 1950 he became a Salesman in the Cleveland Office.

★ ★ ★

Mr. Shutt, 32, graduated from the University of Pittsburgh in 1947 and entered Pittsburgh Steel Company's Sales Training Program. He had various assignments in the General Office until 1948, when he was transferred to the Chicago District Sales Office. In 1950, he was transferred to the Cleveland District Office, where he has been concentrated on the sale of tubular specialties. He has continued in that capacity until his present appointment as Assistant District Sales Manager.

Continental Steel Advances Two Men in Sales Department

Edmond P. Severns, Vice President in Charge of Sales, **Continental Steel Corporation,** Kokomo, Indiana announced two new appointments in the Sales Department effective February 1, 1953. **Howard C. Williams,** Sales Manager of the Sheet Division, is elevated to General Sales Manager. **F. A. Lewis,** Sales Manager of Chain Link and Ornamental Fence Division, is advanced to Sales Manager of the Merchant Trade Division.

★ ★ ★

Upon his graduation from Indiana University in 1934, Mr. Williams started with Continental Steel Corporation in the advertising department. Through the years 1937-38-39, he worked in a territory as a sales representative. Returning to the main office in Kokomo, in 1939, he held various positions on his way up through the Sales Department until his appointment as Sales Manager of the Sheet Division in 1946. He has served in this capacity until his present advancement.

Mr. Lewis graduated in 1922 from Case Institute of Technology, Cleveland. His first position after graduation was in the open hearth and metallurgical departments of the old Corrigan-McKinney Steel Company (now part of Republic) in Cleveland. He then moved on to one of the divisions of the U. S. Steel Corporation where he served in the sales department for several years. Mr. Lewis came with the Continental Steel Corporation in 1930 as District Sales Manager of the Chain Link and Ornamental Fence Division at Toledo, Ohio. In 1934, he was transferred to the main office at Kokomo, and advanced to Sales Manager of this division, a position he has retained until his present promotion.

Made Vice President in Charge of Eastern Division by C. F. & I.

H. C. Allington has been elected Vice President in Charge of Sales of the Eastern Division of **The Colorado Fuel and Iron Corporation** by the Board of Directors, it was announced recently by **F. S. Jones,** Vice President in Charge of Sales of Colorado Fuel and Iron.

EW

HIGH PRODUCTION METAL LOOMS

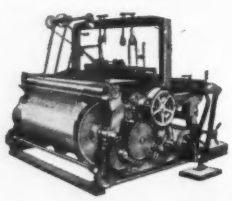
S.A.M.P.

Type BM for mosquito & fly nets, paste factories, armour plate glass, corn sieves, etc.

Type XL for flour mills, chemical and industrial works, etc.

Type CP for "Rabitz" cloth, plastering work, armour plate glass, etc.

Type CM for extra strong metal cloth for sieves, grain, rice, armour plate glass.



Jarach-Guetta, Industrial Overseas Co., Inc.

120 Wall Street, New York 5, N. Y.

General Agents of EMILIO WARTENWEILER,
Via Pergolesi 18, MILAN (Italy)

Mr. Allington's headquarters will be in New York City.

Mr. Allington will supervise sales in the Eastern Division of all products manufactured by Colorado Fuel and Iron and its subsidiaries, including the recently acquired John A. Roebling's Sons Corporation. Colorado Fuel and Iron is the ninth largest steel producer in the United States.

★ ★ ★

He has been General Manager of Sales of the Wickwire Spencer Steel Division of Colorado Fuel and Iron since October, 1947. Before joining Wickwire Spencer Steel as a sales executive in 1943, Mr. Allington served as Eastern District Manager of the Sharpsville Boiler Works, and then as Sales Manager of the Oil Products Division of American Machine and Metals, Inc.

Fulton Appointed to New Position with the Canadian Tube & Steel

Lewis M. Fulton, former assistant general superintendent of **Dominion Steel & Coal Corporation's** plant here has been appointed acting general manager of Canadian Tube & Steel Products Limited, Montreal, it was announced by Lionel A. Forsyth. The firm is a subsidiary of Dosco.

★ ★ ★

Mr. Fulton joined Dominion Steel & Coal in 1911, and was appointed superintendent of the blast furnace department in 1942. He was named to his recent post a year later.

★ ★ ★

In 1949, he was one of a group selected by the company to make a tour of European steelmaking operations.

E. F. Appoints Representative for Michigan District

The Electric Furnace Co. of Salem, Ohio, has announced the appointment of **James V. Burrell** as their Michigan District Sales Representative.

★ ★ ★

Mr. Burrell has been connected with The Electric Furnace Co. for over 15 years in various departments including manufacturing, erection, service and sales. He will handle their complete line of fuel fired and electric furnaces, special atmosphere generators and mechanized material handling equipment, with headquarters in the Company's Detroit office, 312 McKerchey Building, 2631 Woodward Avenue.

Wickwire-Spencer Adds to Chicago Staff

Ralph Ramer was recently appointed Assistant to **L. J. Renner,** Chicago District Manager of the **Wickwire Spencer Steel Division.** The announcement was made by L. A. Watts, General Manager of Sales, Eastern Division at the executive offices of the parent company, The Colorado Fuel and Iron Corporation in New York City.

At Bulova Watch

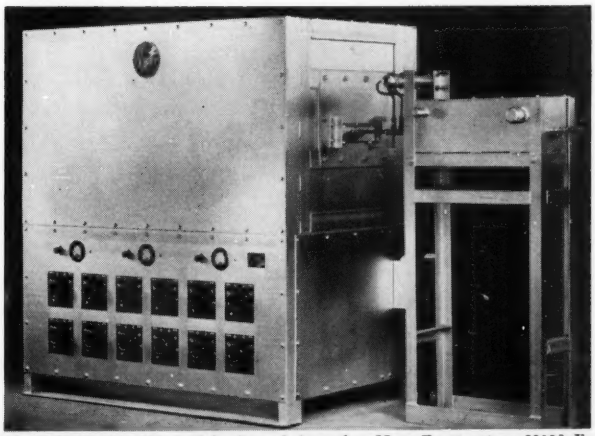
THIS HARPER STRAND ANNEALER UNIFORMLY ANNEALS HIGH ALLOY STAINLESS WIRE

This furnace plays an important part in heat treatment of delicate wire parts for precision instruments and fine watches at the Bulova Watch Company, Long Island, New York.

They are using this Harper Wire Annealing Furnace for annealing a high alloy stainless wire in the temperature range of 1750°F to 2300°F. at the rate of 8 feet per minute. This versatile furnace which at present is in use about 60 hours per week in research capacity will soon be used at full capacity due to increased production requirements.

The advantages of this Harper Furnace for Bulova are twofold: It provides exceptionally uniform temperature control throughout the entire heating zone. It gives them reliable troublefree operation.

We would like the opportunity to discuss your wire annealing problems with you. Let us send you information and recommendations on a Harper Strand Annealer that will give you reliable troublefree operation.



Model HOU-5140-NT, 3 Tube Strand Annealer. Max. Temperature 2300° F.

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WIRE-WORKING MACHINERY

Wire Netting Machines for Chain Link, Hexagonal Mesh, Poultry Netting, Field Fence. Crimping, Barb Wire and Staple Machines. Spring Coilers. Spring End Grinding Automatics. Loop Benders. Upholstery Spring and Wire Mattress Machines. Wire Nail Machinery. Chain Formers. Chain Welders. Straightening and Cutting Machines. Multi-Slide Wire and Strip Forming Machines. Special Machinery for the making of Paper Clips, Lock Washers, Bale Ties, Key Rings, Tin Openers, Wire Bag Ties, etc. Automatics for Flexible Metallic Tubing.

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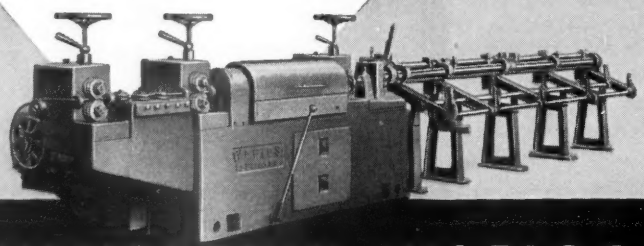

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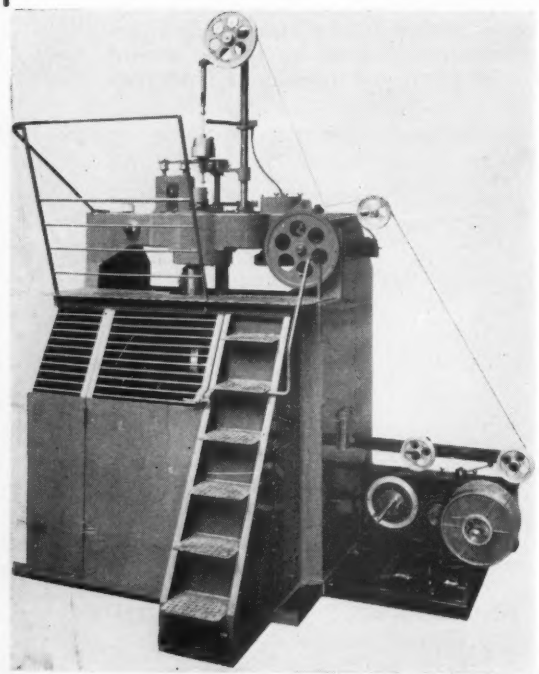
A New Machine . . .

THE POURTIER QUADDING MACHINE



- 2 lays per rotation of the flyer
- Special balancing capacity device
- Automatic stop motion in case of breakage of paper or cotton, on a predeterminated length
- Compensator device controlling the unrolling of the feed-drums and the equality of tension of the four ends
- Double take-up: compensator motion controlling the tension of the quad. Transversal movement of the reels instead of traverse
- Lays easy to reverse and to adjust
- Lockheed braked
- Automatic central lubrication
- Able to be used as a twinner
- Production: 500 lays per minute
- Feed-drums: maximum 16"
- Take-up reels: Maximum 18"
- Lays: from 1 to 7 lays per foot

POURTIER MACHINES

153, rue Gallieni, ROMAINVILLE (Seine) FRANCE

J. & L. Names Three New Vice Presidents

Appointment of three new vice presidents and other important changes in management organization, effective June 1st, were announced recently by **Jones & Laughlin Steel Corporation.**

★ ★ ★

The new vice presidents are:

E. K. Miller, vice president—production.

John E. Timberlake, vice president—sales.

Herbert Johnson, vice president—administration.

John B. Mitchell, executive vice president — production, who is scheduled to retire June 1st, has been named special consultant to the president. Mr. Mitchell will remain active in the affairs of the corporation and will continue as a member of J&L's board of directors, the executive committee, and the management committee.

★ ★ ★

Adam J. Hazlett, executive vice president—distribution, is now executive vice president of the corporation. He will establish the sales policies for marketing the corporation's products.

★ ★ ★

Mr. Miller, as vice president—production, will be responsible for the operation of manufacturing activities at J&L's three steel plants, and the corporation's mining, quarrying, and transportation activities. Mr. Miller was formerly assistant vice president—production.

★ ★ ★

Mr. Timberlake, as vice president—sales, will direct the sales program of the corporation, coordinate sales activities in the sales districts throughout the U. S. and Canada and in the export market, and be responsible for the operation of the supply division of J&L, which has more than 100 oil country goods stores and offices. Mr. Timberlake was formerly general manager of sales.

★ ★ ★

Mr. Johnson, as vice president—administration, will be responsible for establishing programs for organization planning and organization control; wage and salary administration; employee benefits, pensions, group insurance, and executive development. Mr. Johnson was formerly assistant vice president—sales.

★ ★ ★

Mr. Miller, Mr. Timberlake, Mr. Johnson, Mr. Getty and Mr. Lewis become members of the corporation's management committee.

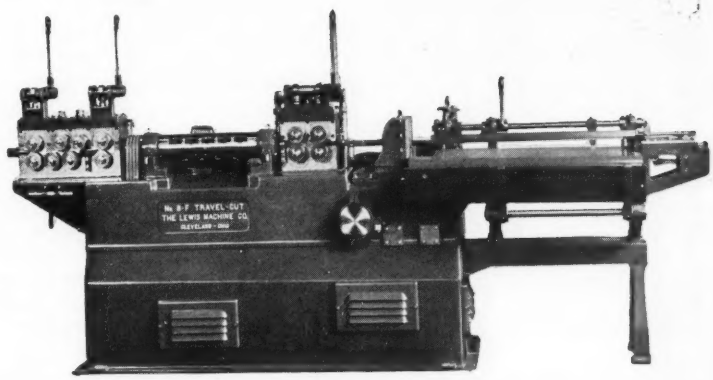
Melville Returns to Wire Field

Norman F. Melville has been appointed general manager of sales of the **Sunbury Wire Rope Co.,** Sunbury, Pa. Since November, 1950, he has been serving as chief of the wire section of the Iron & Steel Division, National Production Authority. Prior to that he had been for many years with Pittsburgh Steel Co. as manager of sales, steel and wire products, and had been active in Wire Association affairs.

Fast, Accurate, Economical

STRAIGHTENING and CUTTING

with LEWIS **TRAVEL-CUT**



22 Models to handle from .012" to ¾" Round, Hex, Flat, Shapes.

Simple in design, rigid in construction, Lewis TRAVEL CUT will deliver continuous dependable service under the most severe, high production conditions—day in, day out. Feeds wire from the coil, straightens accurately, gauges to uniform length, and cuts clean without stopping the wire. For steel, brass, aluminum and alloy wire. Cut your cutting costs with the Lewis TRAVEL CUT. Full details on request.

Exclusive Representatives

EAST: Penn Machinery Co., 117 North Third Street, Philadelphia 6, Penn.

MIDDLE WEST: Steel & Wire Machinery Co., 15457 Euclid Ave., Cleveland 12, O.

CENTRAL: Moslo Machinery Co., 2443 Prospect Avenue, Cleveland 15, Ohio.

WEST COAST: Hoffman & Heartt, 3005 So. Grand Ave., Los Angeles 7, California.

CANADIAN: Empire Engineering Co., 11 738 Dundas St., Toronto, Ont., Canada

CONTINENTAL EUROPE: Gaston E. Marbaix Ltd., Devonshire House Vicarage Crescent, London S. W. 11, England.

The LEWIS MACHINE Company

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Also agents in Paris, Stockholm, Rotterdam, Brussels, Zurich, Milan, Bombay and Melbourne

Retired G.E. Engineer to Serve Michigan Oven as Consultant

Michigan Oven Company, Detroit, builders and designers of industrial ovens, announces the appointment of **E. H. Horstkotte** as their Engineering Consultant for the Schenectady, New York, area.

★ ★ ★

Mr. Horstkotte comes to the company after 40 years' service with General Electric Company, from which he retired earlier this year.

★ ★ ★

During approximately half of this period with General Electric, his work was devoted to the application and development of electrical equipment used in the paper, cement, woodworking, and steel furnace industries.

★ ★ ★

For the last twenty years, he was engineer of the Works Laboratory at their Erie Works. In addition to this activity, during the post war period, he supervised all the planning and construction of the Locomotive and Car Equipment Development Laboratory.

★ ★ ★

His office with Michigan Oven Company is located at 1554 Union Street, Schenectady, New York.

Firth Sterling Appoints Superintendents

Firth Sterling Inc. has announced the appointments of **Robert J. Steele** as general superintendent of the Carbide Division, and **John D. Knox** as superintendent of the Powdered Metals Division.

★ ★ ★

Robert J. Steele

★ ★ ★

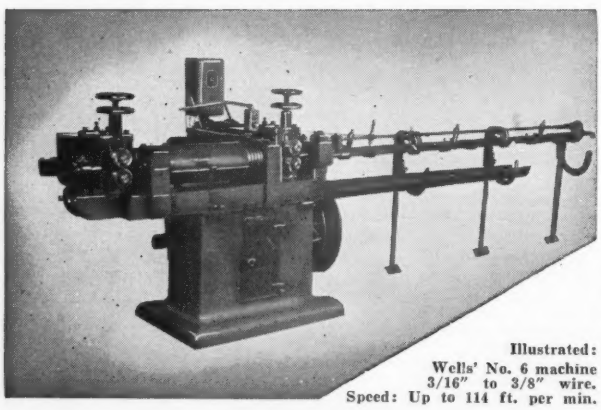
Mr. Steele came to Firth Sterling in 1934 from the Carnegie-Illinois Steel Corp., Duquesne Works. In 1944 he was made superintendent of the Tool and Die Division of Firth Sterling, and following this he became superintendent of the Powdered Metals Division, a position he held until his recent appointment. He attended Carnegie Institute of Technology where he majored in engineering.

★ ★ ★

Mr. Knox joined Firth Sterling in 1940 as an apprentice engineer. In 1948 he became superintendent of Tool Engineering. He then held the position of project engineer in the Research Dept. until his recent promotion. He attended Massachusetts Institute of Technology.

STRAIGHTEN and CUT SMALL WIRES

ON FAST, DEPENDABLE WELLS' AUTOMATIC ROTARY MACHINES



Illustrated: Wells' No. 6 machine 3/16" to 3/8" wire. Speed: Up to 114 ft. per min.

THIS MACHINE WILL CUT wire accurately and fast in any length from 7½" up to 25', but must be ordered for the maximum lengths to be cut.

The straightener flier runs in ball bearings. Has 2 H. P. motor arranged for direct drive. Drive gears are located inside of the base. Illustration shows the flier and drive open to show mechanism.

Furnished with 2 sets of hardened tool steel dies.

WELLS' machines are backed by 58 years of experience and of constant effort to improve their efficiency.

The result for you is a line of straightening and cutting machines that will handle the toughest jobs, day in, day out, year in, year out, with little or no servicing. Customers report uniformly high satisfaction with the operation of their WELLS equipment.

Built in a complete range of sizes for all wire gauges.

send for Catalog No. 50 covering the full line.

Frank L. Wells Company

KENOSHA • **5821 Fifth Avenue** • **WISCONSIN**

Builders of Fine Wire Working Machinery

To Serve as Consultant

Frank J. McLeod has announced his entry into the plastic and allied industries as a consultant and manufacturer's representative. Mr. McLeod has resigned his position as sales manager of the textile division of Glass Fibers Inc., Toledo, Ohio.

★ ★ ★

After receiving his master's degree in chemical engineering from the University of Washington, Seattle, Mr. McLeod was employed in the research department of Rayonier, Inc. Following World War II service with the United States Navy from 1942 to 1946, Mr. McLeod served in various executive capacities with the textile division of Owens-Corning Fiberglas Corporation.

★ ★ ★

With Glass Fibers Inc. from 1948, he served in executive positions, contacting the broad and narrow fabric, plastic, paper and electrical industries.

★ ★ ★

He is a member of the Society of the Plastic Industry and has served extensively on its policy committee.

★ ★ ★

He resides at 752 Inwood Court, Maumee, Ohio.

Made Director of Engineering by C. F. & I.

The appointment of **William Brill** as Director of Engineering for **The Colorado Fuel and Iron Corporation** was announced by Jay J. Martin, vice president of operations for C. F. & I.

★ ★ ★

Mr. Brill has served as chief engineer for the Pueblo C. F. & I. plant since February 1, 1950, designing and supervising construction of new machinery and buildings included in the current expansion program.

★ ★ ★

As director of engineering for the corporation, Mr. Brill will advise and consult with engineering staffs located in various C. F. & I. properties throughout the nation. His appointment became effective May 1st.

★ ★ ★

Prior to his appointment as chief engineer at Pueblo he served as assistant chief engineer from 1945 to 1950. He served as chief draftsman upon his arrival in Pueblo in 1926.

★ ★ ★

Born in Baltimore, Md., he attended Johns Hopkins University and the Maryland Institute. From 1916 until December, 1923, he worked for Bethlehem Steel at Sparrows Point, Md., then went with the National Tube Co., Gary, Ind., where he remained until coming to Pueblo.

Fastener Concern Appoints Sales Executive

Pittsburgh Screw & Bolt Corp., Pittsburgh, Pa., has appointed **Robert B. Algie** as assistant vice president-sales. He formerly was assistant manager of sales, Jones & Laughlin Steel Corp., and more recently was associated with Forbes Steel Corp.

NRM EXTRUDERS
Give you
FASTER, BETTER WIRE COVERING

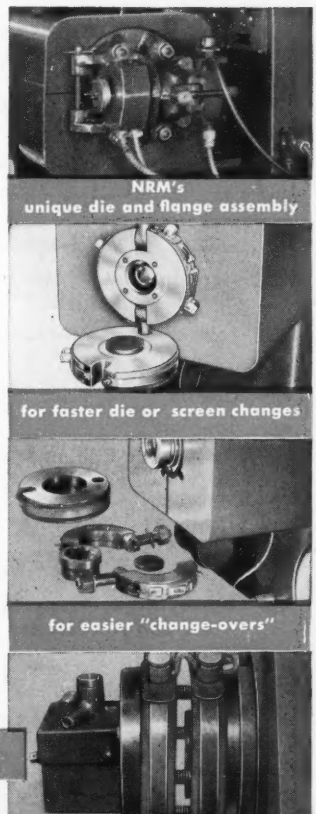
That's right!! NRM extruders have many features designed to give you faster, better covering of wire with plastics.

Take, for instance, NRM's die and front flange assembly—an exclusive feature—engineered to save you time, money, and effort—designed to give you better extrusions through exacting heat control.

Simple and sturdy . . . this assembly swings open quickly — dismantles easily — permits faster die and screen changes and easier "change-overs" from one plastic to another.

Furthermore . . . both the die gate adapter and the flange carry exterior band heaters which eliminate critical heat losses and give more uniform extrusions. For Nylon extrusions, the flange can be completely removed and the Nylon die or crosshead, with heaters, mounted directly on the cylinder face. Such a mounting also permits controlled heating and exact extrusions.

NRM's unique die assembly is now available on its 1½", 2½" and 3½" electrically heated plastics extruders. Write, today, for more information on this and all the features of NRM extruders.



2026

NATIONAL RUBBER MACHINERY CO.

General Offices & Engineering Laboratories: Akron 8, O.
East: 384 Getty Ave., Clifton, N. J.
West: S. M. Kipp, Box 441, Pasadena 18, Calif.
Export: Omni Products, 460 4th Ave., New York 16, N. Y.

Creative Engineering

A Review of Recent Wire Patents

No. 2,637,159, CHAINMAKING APPARATUS, patented May 5, 1953 by Robert L. Cooks, Attleboro, Mass., assignor to Charles D. J. Smith, Attleboro, Mass.

Two pairs of edge-mitered rolls are provided at right angles to each other, having depressions on their circumferential surfaces which follow the exterior form of the chain to be produced, and each opposed pairs of rolls having shoulders at right angles to the axis and annular faces parallel to the axes presented to the shoulders of the other set of opposed pairs to limit the movement of the axes of each pair of rolls toward each other so that the work forming edges may not interfere.

No. 2,637,365, WIRE FABRIC BENDING AND FEEDING APPARATUS, patented May 5, 1953 by Raymond F. Stockton, Sunland, Calif., assignor to Ray F. Stockton Wire Products Co., Inc., Burbank, Calif., a corporation of California.

This apparatus comprises a series of opposed rolls between which the fabric can be fed, one of the pairs consisting of a rubber roll and its opposed roll having a rubber center and metal plates flanking the rubber center, the plates having edges arranged in opposition to the rubber roll, one of the plates presenting an outer side face shaped in radial section to conform to a portion of the shape of the finished product, and a roll arranged in opposition to a portion of this side face to press a portion of the fabric against the face so as to be shaped thereby.

★ ★ ★

No. 2,637,509, COIL UNREELER patented May 5, 1953 by Godfrey Stanius, Chicago, Ill., assignor to Acme Steel Company, Chicago, Ill., a corporation of Illinois.

Strapping or the like may be supported by the apparatus which, in addition to the reel, includes a brake comprising an expansible and contractible helical spring adapted to engage a part of the reel for controlling its rotation, and a device actuated by a portion of the strapping being withdrawn from the coil for controlling the expansion and contraction of this spring.

★ ★ ★

No. 2,637,858, SPRING MATTRESS CONSTRUCTION, patented May 12, 1953 by Nathan C. Goldberg, New York, N. Y.

The spring structure is characterized in that each of the longitudinal tiewires is formed with widened areas each consisting of zigzag bendings of substantial transverse extent, and each constituting a generally horizontal open-work load—supporting area of tiewire midway between the coil springs.

★ ★ ★

No. 2,637,896, MANGANESE ALLOY COATING ON FERROUS BASE AND METHOD OF PREPARATION, patented May 12, 1953 by John Simon Nachtman, Washington, D. C.

A corrosion-resistant coating is formed by diffusion of electro-plated metal layers, at least one of which is metallic manganese.

★ ★ ★

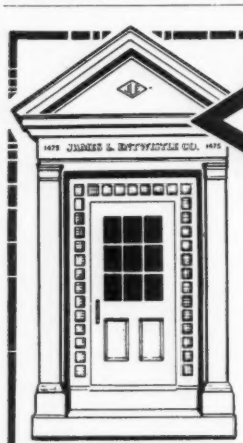
No. 2,638,207, METHOD AND APPARATUS FOR FORMING WIRE AND THE LIKE, patented May 12, 1953 by Robert P. Gutterman, St. Paul, Minn., assignor to Engineering Research Associates, Inc., St. Paul, Minn., a corporation of Minnesota.

Apparatus for continuously drawing attenuated metal stock in great lengths is disclosed, comprising a die, a device for vibrating the die parallel to the movement of the stock, a drum of raw stock, a power driven drum at the leading end of the stock that provides the drawing force for the stock, and a device for damping out imposed longitudinal vibrations in the stock on either side of the die, this device being located at nodal points of the longitudinal vibration of the stock, while the die is located at an antinodel point of the longitudinal vibration of the stock.

★ ★ ★

No. 2,638,278, WINDING MACHINE WITH MINIMUM TURN SPACING DEVICE, patented May 12, 1953 by Benjamin B. Scott, Schenectady, N. Y., assignor to General Electric Company, a corporation of New York.

A yieldable turn spacing member on a feeding means is provided together



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SERVING THE WIRE INDUSTRY THROUGHOUT THE WORLD

- Caterpillar Pull-outs
- Standard Sets of Spark-Testing Equipment
- Take-ups and Re-spoolers
- Reelers
- Coilers
- Spoolers
- Collapsible Coiling Reels
- Wire Sparkers and Accessories
- Hand Locators
- Electrode Units and Stands
- Measuring Machines, Counters and Accessories
- Wire Guide Units
- Pay-off Reels Stands
- Electronic Devices
- Shaftless Take-ups and Payoffs
- Wire Pre-Heater
- Disk Brakes and Controls, Drag Units and Slip Clutches
- Wire Marking Machines, Type Strips, Inks
- Labelling Machines
- Pneumatic Equipment and Controls
- Special Machinery for the Wire Industry
- Hydraulic Equipment and Controls
- Hi-Pot Test Sets
- Cable Handling Equipment for Warehouse Use

See Page 664 for News of JLE Shaftless Take-Up

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BURY ROAD, RADCLIFFE, LANCASTER, ENGLAND

JLE JLE JLE JLE JLE

with means for tensioning the spacing member, the spacing member being physically oriented for interposition between the wire and the last turn on the support for spacing each turn a predetermined distance from the preceding turn.

★ ★ ★

No. 2,638,818, WIRE FINISHING METHOD AND APPARATUS, patented May 19, 1953 by George John Stevens, Baltimore, Md., assignor to Armco Steel Corporation, a corporation of Ohio.

The apparatus includes a centrally-orificed base plate through which the metal wire stock is supplied, and a series of transversely and diametrically split, centrally-orificed cutting dies carried by and disposed in spaced relation both to the base plate and to each other, with their orifices in the axial prolongation through the base plate-orifice, the diametrically-disposed transverse split of each set of dies being angularly offset with respect to the split in the other set of dies.

★ ★ ★

No. 2,638,859, MACHINE FOR MAKING COAXIAL CABLE, patented May 19, 1953 by Paul Charles Emard, Lyons, France, assignor to Compagnie Generale d'Electricite, Paris, France, a French joint-stock company.

One purpose of the invention is to make the central conductor integral with the insulating blocks and surrounded by a tubular body constituting the external concentric conductor formed of two metal strips.

No. 2,638,943, COIL WINDING DEVICE patented May 19, 1953 by Kenly C. Bugg, Fort Wayne, Ind., assignor, by mesne assignments to Kendick Manufacturing Company, Inc., Fort Wayne, Ind., a corporation of Indiana, nominee.

Coils of substantially any shape may be wound by the device disclosed, according to the specification of this patent. There are nine claims.

★ ★ ★

No. 2,639,035, SIFTING AND STRAINING DEVICE, patented May 19, 1953 by Joseph Pearlstein, Arlington, Va.

The device comprises two telescoped open cylinders of wire.

★ ★ ★

No. 2,639,245, SULFIDE COATING, patented May 19, 1953 by John Edgar Baxter, Detroit, Mich., assignor to Parker Ruse Proof Company, Detroit, Mich., a corporation of Michigan.

A composition for forming a sulfide coating on a steel surface is disclosed which consists of an aqueous solution of a member of the group consisting of the sulfide ion and ions which form the sulfide ion through reduction on the steel surface and in a proportion equivalent to about 0.3-1.3% sulfite ion; a member of the group of anions consisting of chloride, bromide, and iodide in a proportion of about 1% to about 5%; and an acid selected from the group consisting of sulfuric, hydrochloric, and nitric in a proportion sufficient to provide a pH in the range of about 0.3-1.1.

★ ★ ★

No. 2,639,735, FLAW DETECTOR FOR WIRE MESH LOOMS, patented May 26, 1953 by Nickolas W. Fisher, Cleveland, Ohio.

This detector is adapted to a loom of the type that weaves wire screen and advances the woven wire screen horizontally forwardly from a fell.

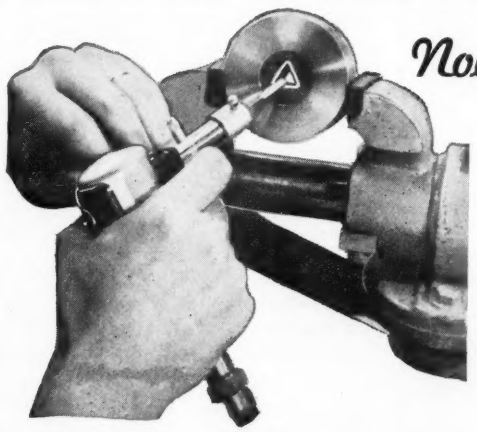
★ ★ ★

No. 2,639,758, WIRE STRAIGHTENER, patented May 26, 1953 by Richard D. Heller, Tujunga, Calif.

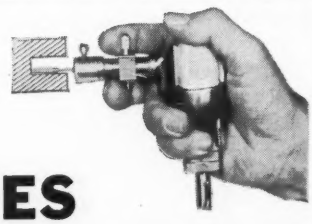
Wire straightening mechanism is disclosed comprising a first, a second, and a third strand guiding means closely spaced in succession along the strand's path of advance, and each comprising a sheave lying in a plane which generally corresponds to the plane of the strand's coil and about which the strand is wrapped in the same sense as it lay in its coil, to hold the strand against rotation about its own axis intermediate any two of these sheaves, a device located to engage and deflect the strand, intermediate two such sheaves, transversely to the plane of its coil set, to remove its helical set, if any, and a further device located to engage the strand, intermediate one of the first two and the other such sheave, and to deflect it counter to its original coil set.

★ ★ ★

No. 2,639,763, WIRE SPRING, patented May 26, 1953 by William H.



Now You Can



REPAIR
CARBIDE DIES
50 TIMES FASTER

Than by the old hand filing method
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This tool is light, portable and fast-cutting. Comes equipped with a set of diamond files and hones and can cut, lap and polish at unprecedented speeds—the tools are operated at 28,000 strokes per minute. Good for round dies, but especially efficient and fast on shaped dies, doing a job that normally takes hours, in a matter of minutes.

This remarkable new tool, of which hundreds are in daily use, is inexpensive to buy, easy to use and produces excellent results at great savings of time and money. Has many other uses and will be found an invaluable aid in mill maintenance repair shop work. Get the facts today and ask for a demonstration.

Nord International Corp.

P. O. BOX 44W, DENVILLE, N. J.

Neely, Cleveland, Ohio, assignor to The Universal Wire Spring Company, Cleveland, Ohio, a corporation of Ohio.

An integral, elongated wire spring for seat structures is covered by this patent and includes a flat, sinuously corrugated, resting portion and supporting means for the resting portion extended from opposite ends thereof, this supporting portion embodying successive left and right handed loops connected by cross wire members spaced from each other a predetermined distance and other successive left and right handed loops connected by cross wire members spaced from each other a predetermined distance different from the first distance to provide a resting portion including areas of different yield to loads placed thereon.

★ ★ ★

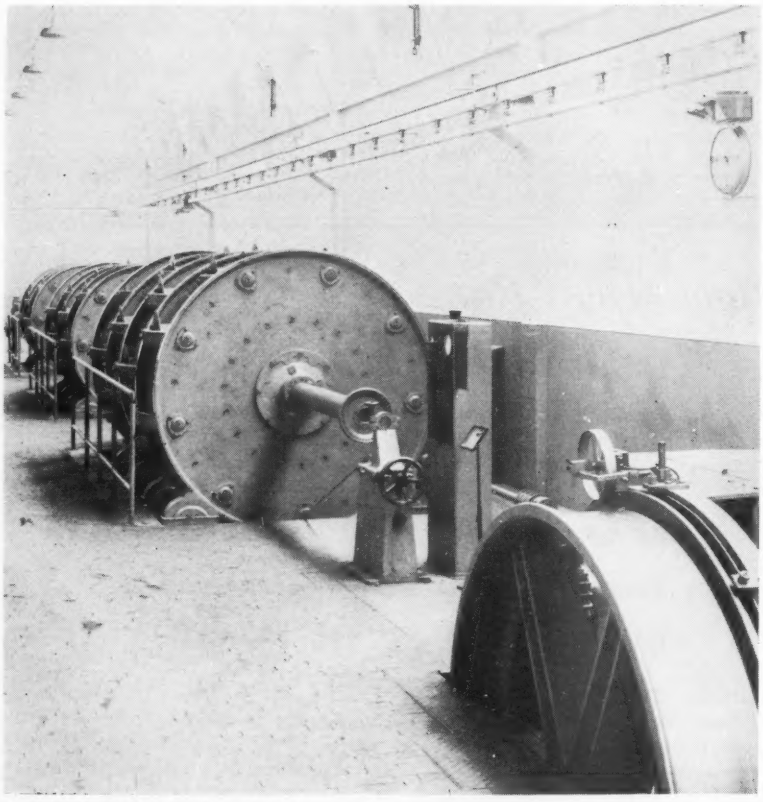
No. 2,639,873, WIRE PACKAGE, patented May 26, 1953 by John H. Smith, Wauwatosa, Wis., assignor to General Cable Corporation, New York, N. Y., a corporation of New Jersey.

This package is for an open-center coil from which wire is to be payed out from the center, and comprises a helically wound lining for the open-center coil, having a tab at its inner end and having its outer end connected to the lead end of the coil of wire, discs at opposite ends of the coil, at least one of which has a central opening providing access to the tab, and a shell around the outside of the coil connecting the end discs.

MAILLEFER S.A.

RENENS - LAUSANNE (SWITZERLAND)

MACHINERY FOR THE WIRE INDUSTRY



Core + 18 + 24 + 32 + 36 Bobbins Strander

Heavy Duty Cage Type with Adjustable Back-Turn; Fully Ball-Bearing Mounted; All-Steel Construction of Cages. Unsurpassed Speeds. Shaftless Fixing of Bobbins, with Slack Absorbing Device.

Inquiries to: Maillefer S. A., Renens, Switzerland.

Introduces Two New Spooling Machines

Boyd & Sons Manufacturing Company, 1934 Callowhill St., Philadelphia, 30, Pa., has introduced two new spoolers.

★ ★ ★

One of these is a heavy duty spooler, designated as Model No. 1200, which is designed for spooling or coiling heavy materials on large diameter spools or in coils. The machine is a constant speed type and is sufficiently versatile to be adapted to a wide range of requirements in spool or coil diameters and traverse widths.

★ ★ ★

The other is a rugged bench spooler, simple in design, yet precision made. It is the Boyd No. 6000 spooler. It is equipped with one or two spindles, having a common traverse with individual drives for each spindle. These may be started independently. Traverse rates and travel are quickly changed to suit needs. Can be adapted to wire, tape, plastic, etc.

★ ★ ★

Boyd & Sons Manufacturing Company are large manufacturers of spooling equipment and make such equipment in a complete range of sizes for every spooling need.

Essex Announces Aluminum Flux

A new fluxing compound for use in soldering aluminum has just been announced by the **Essex Wire Corporation.** Differing entirely from conventional fluxes, this new product, known as S-X Aluma-Flux, now makes possible the non-corrosive soldering of aluminum alloys, (except a few containing high percentages of silicon) as well as the joining of aluminum to other metals. It may be used for manual, dip or mechanical production soldering operations, either in powdered form as delivered, or in molten form with equally satisfactory results.

★ ★ ★

During several months of impartial tests by Battelle Memorial Institute, Aluma-Flux proved it-

self as a universal flux, equally effective for soldering stainless steel, bare and galvanized carbon steel, cast iron and all other ferrous metals, copper, brass and nickel—all commercial metals commonly joined by soldering. The coating of copper with tin and the joining of unlike metals was also easily accomplished with Aluma-Flux.

★ ★ ★

Soldered joints in aluminum produced no corrosive action due to flux residue when exposed to salt spray, high humidity, alkaline water, etc. Neither was there any detrimental effect over protracted periods on the joined surfaces.

★ ★ ★

This compound may be stored in powdered form or maintained in molten form indefinitely with no impairment of fluxing efficiency, and without any change in weight, or chemical and physical properties. Being non-hygroscopic, Aluma-Flux will not absorb moisture in any normal atmospheric condition.

It is being distributed nationally by Insulation and Wires Incorporated in convenient size metal containers. Complete technical and application data may be obtained by writing them at 3435 Chouteau Avenue, St. Louis 3, Missouri.

Westinghouse "Automation" Display Coach Starts Tour

"Automation," one of the hottest industrial subjects today, has been put on wheels by **Westinghouse Electrical Corporation.** As the theme of a unique display coach developed by the Standard Control Division, it is being taken directly to design engineers, maintenance people, and supervisory personnel in the machinery manufacturing industry throughout the United States. The exhibit will show how common electrical devices such as linestarters, control stations, motors, and circuit breakers—the "nuts and bolts" of any electrical system—can be used to achieve successful automation.

★ ★ ★

To make it easy for the customer's people to attend a showing, Westinghouse takes the coach to the customer's plant and runs consecutive 1-½ hour programs for groups of ten to twelve engineers at a time. The introductory portion includes movies on the subjects of "Automation Economics" and "Automation Mechanics."

★ ★ ★

After the first portion of the meeting (approximately 20 minutes) informal presentations are given at each display—many of which are animated to simulate actual factory conditions. The displays are arranged so that the engineer following these informal talks gets a progressive picture of the best practices of automation today.

★ ★ ★

The coach has started a tour of the mid-western sector and is expected to make some 350 plant visits over a period of 14 months.

WEMCO BOBBIN WINDER

Type B-1

A semi-automatic machine designed to be situated at the loom and operated by the weaver. It eliminates spooling benches and the transport of full and empty bobbins. By utilizing inherent idle time, it increases the loom operator's efficiency. At the same time, it reduces the number of bobbins required to three per loom and decreases damage and wear on bobbins. Affords better utilization of floor space, more accurate control of the wire used for fill and more consistent color in the finished product.

WIRE RANGES:
.002" to .050" — all metals.

BOBBIN SIZES:
2" to 6" flange diameter; .250" to .840" between flanges.

WIRE EQUIPMENT MANUFACTURING CO., INC.
1168 South Olden Avenue
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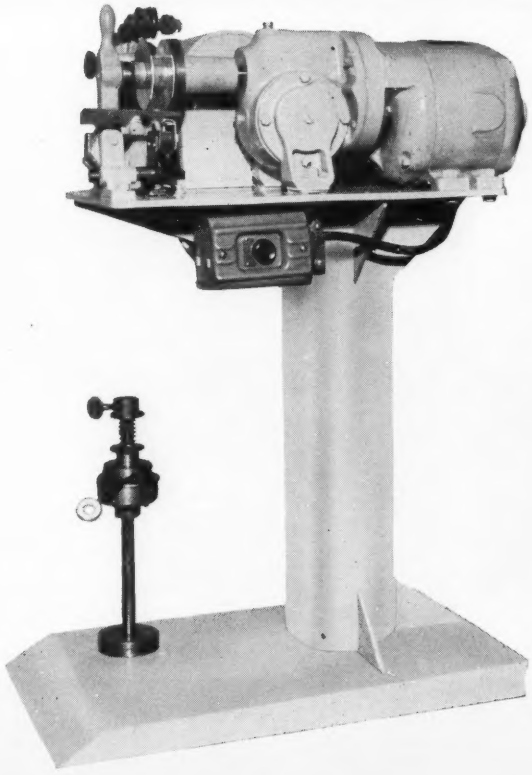
Phone: TRenton 6-9908



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SINCE 1870
A New Universal Automatic Multi-Slide Bending Machine
suitable for the fully automatic, economical mass production of all types of components from wire and strip material.
Special Features:
• Vertical, enclosed construction, requiring the minimum of floor space.
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• Simple tooling, easily adjusted and changed.
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Our special leaflet giving details on the range of application of our automatic multi-slide bending machines is available on request.
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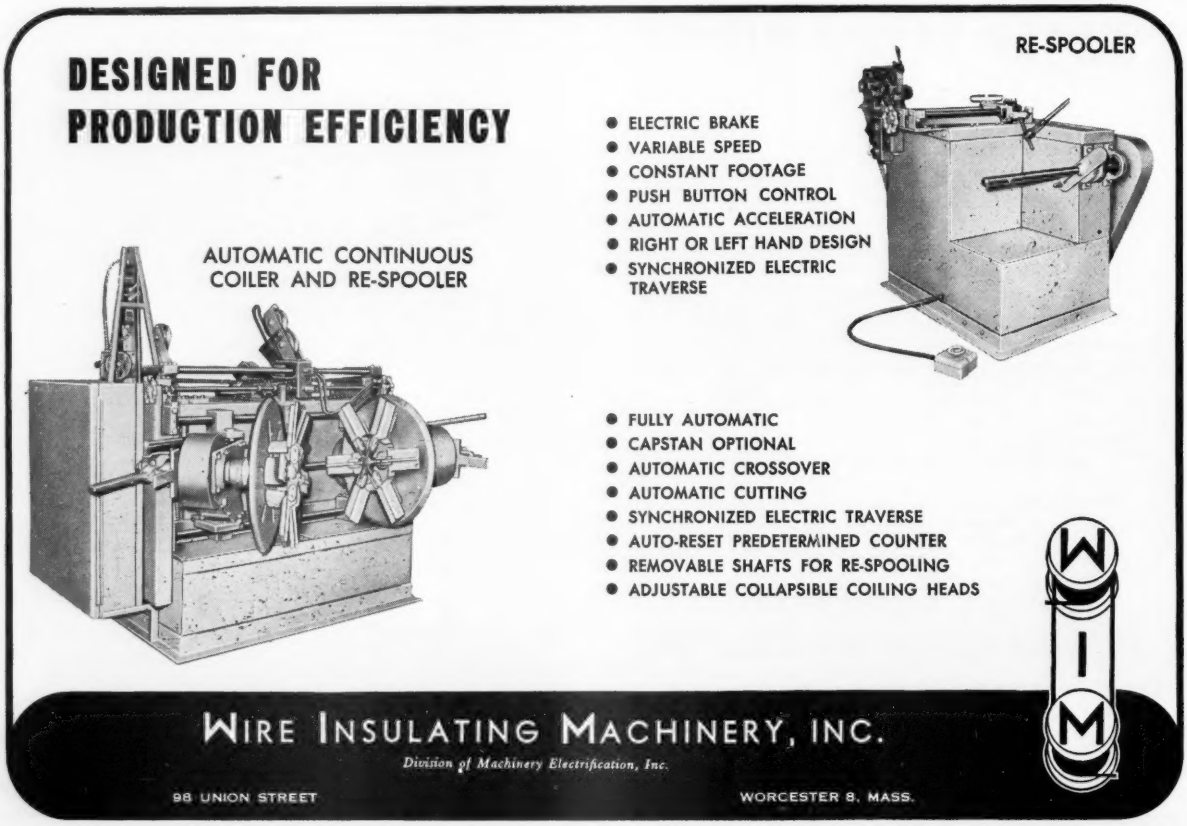
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AUTOMATIC CONTINUOUS COILER AND RE-SPOOLER
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• RIGHT OR LEFT HAND DESIGN
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• AUTOMATIC CROSSOVER
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WIRE INSULATING MACHINERY, INC.
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98 UNION STREET
WORCESTER 8, MASS.
W
I
M

Inhibitors vs. Accelerators

(*Continued from page* 681)

its strength on long exposure to hot acid, and to dissolving steel?

(2) How much of it is removed on the surfaces of the metal pieces passed through the bath?

(3) How much and how stable a foam does it produce, if any?

(4) Does it have suitable physical attributes, e.g., does it cake in the container, if solid, or stratify if liquid? Is it readily dispersible in the pickling bath? etc., etc.

★ ★ ★

Nevertheless, these questions **can** be answered **and** a number of merit assigned. By properly assigned tests, this number of merit can be translated into dollars and cents. Of the dollars and cents story we need tell only this much: An inhibitor is used because it saves more than it costs. Of two inhibitors the more costly may well produce the greater saving. The point is that inhibitors have their defined major function, which is measurable.

★ ★ ★

Suffice it to say, further, that reduction in metal attack inevitably saves acid and reduces loss of metal during pickling. In some instances, because of uniformity of scale to be removed it is possible to remove the scale with small metal loss. An example is found in the continuous strip pickler. However, it is still economical to use inhibitors in these picklers because of the insurance it affords against loss due to overpickling during breakdown or stoppage for other reasons. The saving made during one such stoppage will more than pay for quite a little inhibitor. In any case, the utility of inhibitors is established by quantitative data from both laboratory and plant.

★ ★ ★

The subject of "accelerators" is difficult to discuss because of a lack of precise knowledge as to what is meant by the term. Early in our experience with inhibitors, many efforts were made to find substances, which, when added to an acid bath, would greatly accelerate the rate of attack. A few substances were found which did this to a small extent. None of the results were so favorable as to be considered of really practical importance. I presume then, that the so-called "accelerators" referred to in the title of this symposium must not be substances which accelerate the rate of acid attack, per se, but which in some other way benefit the behavior of the pickling solution. It is to be hoped that the discussion will clarify the meaning of the term to the end that useful conclusions may be drawn therefrom.

★ ★ ★

In the meantime, I shall assume that among the "accelerators" to be referred to, are included substances which perform one or more of the following functions:

(1) Reduce the surface tension of the solution

(2) Improve the detergent power, (for oily or greasy contaminants of the work, for example)

(3) Increase the chemical activities of the solution for scales of special composition, for example those

SPECIAL
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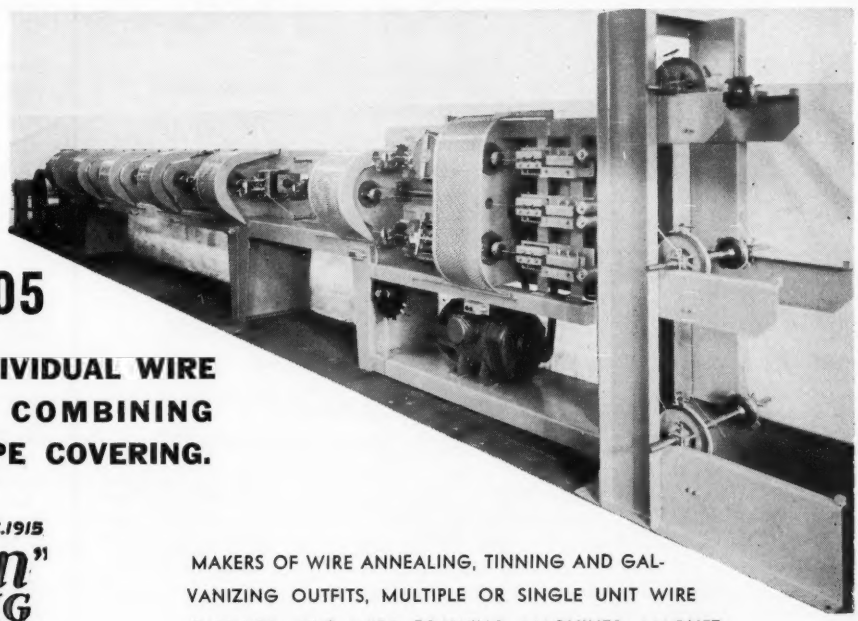

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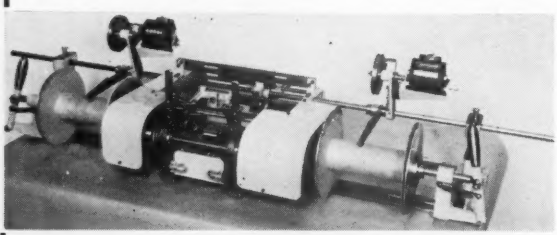

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This may result in appreciable saving under some circumstances. It may also allow working pickling solutions to somewhat higher iron content, since the amount of iron salt remaining on the surface of the work is reduced because of the more complete drainage of solution therefrom.

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Our position is that since there can be no conflict between different desirable ends, we can see no real controversy involving "Inhibitors vs Accelerators" (if we have correctly interpreted the term accelerator).

★ ★ ★

The use of auxiliary agents in no way supplants the usefulness

of inhibitors.

Note: The discussions that followed the introductory remarks made by panel members, due to their extensiveness, will appear in the August issue of Wire and Wire Products.

Applications of Koldwelding

(*Continued from page* 674)

Steel Company to give his discussion of this paper at this time.

MR. WHITNEY: Mr. Barnes has presented a most interesting paper on this comparatively new method of welding and particularly its application to the wire industry. This is, of course, only one phase of the development work that has been carried out. I have seen samples illustrating an amazing number of types of products which have been Koldwelded, indicating the wide field of its possibilities.

Basically, the process appears to be about as simple as one could hope for —consisting merely of scratch brush cleaning followed by pressure to produce the weld. While simplicity in operation is to be desired, Mr. Barnes has stressed the point that each job must be specifically engineered for the best and most consistent results. The application of the process is therefore not as simple as it first appears and the services of the Utica Drop Forge and Tool Corporation can be of great assistance to the potential user not only from the standpoint of obtaining good results but in avoiding unsuitable applications.

As indicated in the paper, "the technique of cutting is critical and varies from material to material, temper to temper of the material and size." In addition to this, it is stated that "this cutting operation is also the gauging means for obtaining the proper projection of the wire from the dies for best welding." From these two statements, it is apparent that the success of the operation depends to a considerable extent on this apparently simple job of cutting the wire. This suggests the possibility that dragging, or smearing, of the metal over the faces to be welded must be avoided to obtain satisfactory preparation of the material. If this is true, I should like to inquire whether any previous cold work on the wires would affect the weld strength.

It was not entirely clear to me from the context of the paper whether this type of butt welding was adaptable to hard drawn wire as well as to hot rolled rods or annealed wire. In either case, the weld area will have a greater amount of cold work than the adjacent wire and consequently will represent a hard spot in the material. While it was stated that wire containing welds of this

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type had been drawn to fine wire on high speed machines, I believe it would be of interest to know the practice used and whether the condition of the weld area reduced the number of drafts that would normally be applied to this type of material.

Some mention was made in the paper about the cross welding of wires. Under such conditions, the two wires would have only a point contact. Is this sufficient or is it necessary—as I have understood in some cases — to preform one wire into a Z-shape so that a line contact will be obtained for the weld?

To compete with the more conventional methods of joining wires for continuous operation, the Koldwelding practice will have to be quick, positive and easy and apparently the Utica Drop Forge and Tool Corporation are attempting to do this by special design of the tools.

MR. BARNES: Mr. Whitney's first point about the smearing of the wire—if you don't smear the cut, you don't get a weld because it is the broken-up metal, through further breaking up and pushing together, that make a weld. You have to get a smeared cut. You can't get a broken cut or you can't get an absolutely clean cut. As Sowter found out in the first place, if he cut his metal with sharp shears he didn't get it stuck together; if he cut it with dull shears, it stuck. You have to follow that through and get your smeared cut in order to get a weld—it prepares your surface.

Of course that offers certain problems in design of the operation of a cutter. That isn't too critical on aluminum but when you get into copper, it does become critical. The cutters have to be kept in pretty good shape and operated carefully; on aluminum we don't seem to have too much trouble.

Mentioning this cross-wire weld, I have seen cross-wire welds in England. We have done a few of them but we dropped work on that part of the process in favor of the other because inherently it is not too strong a weld and you have to clean in advance—and when you have to clean with a scratch brush you introduce a human element and until cold welding is thoroughly established and people understand it; we would rather have the process inherent in the tool and not dependent on the human element. I believe that covers your point.

MR. WHITNEY: There was one other point in regard to the reduction of the number of drafts your company processes.

MR. BARNES: We are not too familiar with wire mill processes. It is something we are going to get into up to our necks; but several of our friends in the Wire Industry have taken aluminum wires, as we have ordered them, and drawn them down on a high-speed machine from .164 to .011 in one continuous operation; and copper has been drawn down. There doesn't seem to be any question but that it can be done.

When you get into different tempers of copper wire, you may have to have some adjustment to make, mainly in the field of cutting. There is one aluminum alloy so far that we in Utica have not had any luck with. That is 56S. The English have been successful in welding it. I have simply seen samples 5/6 inch in diameter—and good welding. We

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haven't gotten into that yet. We have information from the laboratories under whose rights we are licensed; in due course of time that will be taken up.

CHAIRMAN CORNELIUS: The meeting is now open for general questions from anybody.

A MEMBER: You mentioned the physical values of the cold weld. Besides their use with copper and aluminum, we are also interested in the electrical values. Have you any values on that?

MR. BARNES: There seems to be no appreciable difference in resistance of the cold weld—and in fact in welding some aluminum, samples of which I have here, we obtain a much better weld resistance than with the customary method of doing it.

A MEMBER: The properties of the cold weld—since the cold weld is introduced at one spot of the wire, have you any indication of the fatigue values which might obtain from such a weld?

MR. BARNES: We have not run any fatigue tests; we plan to start that type of test as soon as we are fully acquainted with the type of fatigue tests that you people in the Wire Industry would expect us to meet. There does not seem to be any question about it. We have set up machines and pushed them back and forth, but that isn't a fatigue test but, as yet, we don't know what standards to meet.

A MEMBER: You mentioned quite frequently the number of different sized tools to butt weld wire. I wonder within the tolerance on a wire diameter—we are speaking of .064 wire and that may vary up and down half a thousandth of an inch—will your tool cover that range or a wider range?

MR. BARNES: One set of tools will give your customary variation on that gauge, but if you change to another sized gauge, you would have to change your dies.

A MEMBER: Welding material is strictly a pressure phenomenon or pressure-time relationship; is the time factor of importance?

MR. BARNES: You are talking of about a quarter to three inches; it can't seem to be of any importance. Some times, using a hand tool, a man will say he gets better welding doing it fast than slow; but I think that was pushing the technique. I have never been able to notice any difference and we have done it by impact and very slowly and get just the same type of weld, as far as we could see.

A MEMBER: I wonder if Mr. Barnes could tell us whether cold welding of different alloys together has been done or even tried. I recall that the pre-Columbian Indians started out making jewellery of golden-platinum by cold welding in ancient times and they produced a complete alloy between those two very high welding metals.

MR. BARNES: We have welded copper to aluminum. We weld copper to aluminum and various alloys of aluminum to aluminum and various alloys of copper to copper and to aluminum. However, when you try say, brass and zinc, the welding efficiency drops quite rapidly. The English have been more successful than we have; they have gone into the theory better than we have. Our procedure is designing and making prac-

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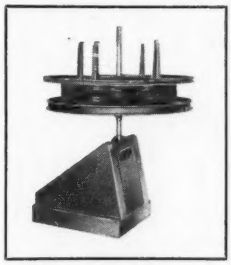

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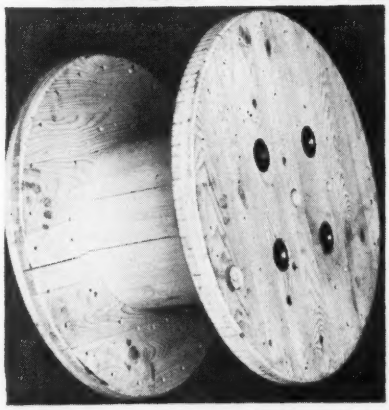

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tical tools so you gentlemen can use them and get results out of them, and the need seems to be something that will join different grades of aluminum in the manufacturing and fabricating processes —and also the common welding of copper. So we will approach the problem of welding the more complicated alloys as we get to them.

CHAIRMAN CORNELIUS: If we have no further questions, Mr. Barnes will demonstrate some welds here.

(Mr. Barnes gave a demonstration of welding.)

CHAIRMAN CORNELIUS: Thank you, again, Mr. Barnes for a very interesting talk.

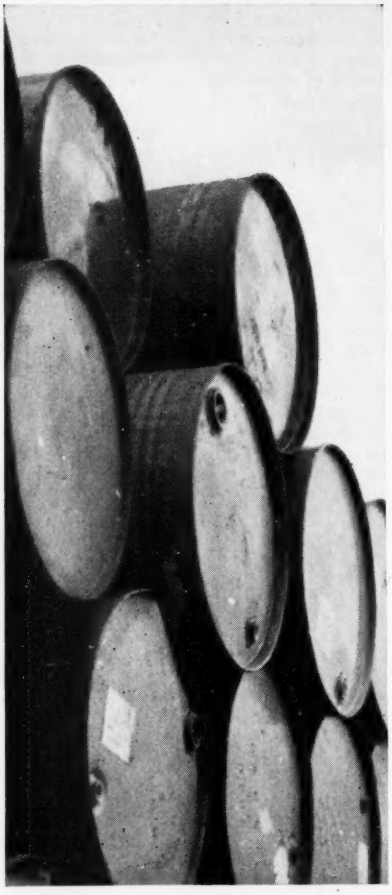
Shaving for Non-Ferrous Wires As Practised by Canadian General Electric Company

(*Continued from page* 678)

out the years have attempted to improve the surface quality of the drawn or cold rolled end product where superior surface finish is desirable or necessary. From the early attempts, years ago, to provide a smooth nose ring for that sensitive fellow, the bull, to present day practise that need has been recognized and efforts made to attain it. We heartily concur with Mr. Moher's remarks on the improvements obtainable with the Shaving Process as far as they go. These improvements are due to the elimination of oxide inclusions present due to rolling mill imperfections in the rod and, in the case of copper, from the elimination of a portion of the oxide inclusions present in the set of the original wire bar.

Mr. Moher makes mention of the scalping of wire bars before hot rolling into rod. Scalping of standard horizontally cast wire bars will remove a portion of the oxide inclusions segregated in the set area. It does not remove them all. Subsequent shaving of wire drawn from rod rolled from scalped bars may or may not remove the balance of the oxide concentration remaining after the scalping of the original wire bar depending on the size of rod used and the depth of the shaving cut. This remaining oxide concentration can cause trouble in fracturing of say drastically reduced rectangular copper with large width to thickness ratios if it is subjected to edgewise bending and the oxide concentration is located on the outside of the bend. In cold heading copper rivets from wire the head is liable to fracture in this oxide rich area. Such fracturing of magnet wire reduces the cross sectional area far below the design size and can and has caused overheating and damage to insulations at this point. Actual mechanical damage to the insulation can also occur.

We are fortunate to have available in Canada, tough pitch copper, vertically cast into wire bars which contain no set and in which oxide concentration is not present and which are superior in this respect to scalped horizontally cast wire bars. By their use in conjunction with the Shaving Process, magnet wire manufacturers can roll rectangular wires with large width to thickness ratios much further without process anneals and with no fear of edge fracturing in rolling or in subsequent winding operations.



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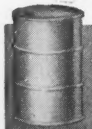

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This (showing bar of copper) is a product that the magnet wire users use. By all the fundamental metallurgical rules, it should not be, but however there it is—a beautiful little job. On the other hand we have this (a second bar of copper) that is an end-poured bar—this one is an abortion, while this one is sound, metallurgically right. Nobody would think of even conceiving a thing like this one. The copper people do it because price-wise it pays them to do it. This metallurgically is sound; it is a nice sound structure, a vertical case. We have no concentration of oxide on the top portion, as has this horizontal bar. We have no porosity present as you have across this little demon here. This one bar is not fundamentally right. This good bar is 8.75 throughout the whole cross-section.

CHAIRMAN CARNAHAN: Mr. Sherman, thanks for your paper and your remarks.

Are any of the Aluminum boys here? Shaving is in their field and they may be able to throw some light on what is being done on shaving aluminum. It might be of some help to Mr. Moher. Likely he has tried it and it is possible they are doing it.

A MEMBER: The previous speakers have had, likely, years of experience to our days in rod shaving. We are doing some work in Shawinigan and possibly at some future time we will have something to tell you, but at the present time we don't know very much.

CHAIRMAN CARNAHAN: Gentlemen, we have appreciated your attendance and the hour is late. So if there are no further questions, the meeting is adjourned.

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Methods-Time Measurement

(*Continued from page* 670)

job in order to get the time. The two have been combined.

Now, we can look at motions; put them to go in any combination. I can stop my hand in mid-air and establish a standard for it, if it was needed; so we have a tool to evaluate the change between one thing and another. As such we do apply basic work simplification in MTM, too. Just training a man in MTM is not the whole answer; the man has to have the ability to look at things and improve them. But with the procedure, we see in these highly-controlled operations certain little red flags popping up which immediately are the type of warning flag that we want to look at in that motion and see what we can do to reduce it—because if they were all nickels and dimes or pennies we wouldn't worry; but when we see those $5.00 bills cropping up, we want to study it. It is a combination of work simplification, too, but the value of MTM is that we can look at the operation that is being performed now; we can set up the pattern, the time standard, and we can see that now we would like to do it this way. I can evaluate the time for that job. I can see the saving and find out whether it is justified to make the change in the equipment and the tooling.

Now, I didn't mention tool fixtures and design. If you can properly design in your drawing and your operational work the least manual content to operate the fixture, then each time that fixture is used, the man is saving time; but if the fixture is designed wrong and in operation—then you know, as well as I do that the change of certain dies and other things sometimes becomes a matter of hundreds of dollars to make the change whereas for a small investment originally you could have built it the proper way.

So we have a device which you do not get from work simplification to evaluate the effect of a change before the change is made. That, I think, is the key point in the use in the work simplification area. It, in itself, is not going to give you a new method, of course. Does that answer your question?

A MEMBER: I don't think any industrial engineer going through a plant and studying 50 or 100 jobs can get the answer from such standards. Take a case of grinding gears where they varv the speed and different classes of wheels; you can set a standard and tighten up on it and in 6 months you tighten up on that and in 6 months more they are still hitting the top. There is nobody, to my mind, who has all the answers that can give the proper standard anywhere near proper in the first studies.

MR. BUGBEE: Obviously we can not touch process time.

A MEMBER: In the early days I ran 6 blocks and another man 10 blocks and he sat down on it and I went home and took salt out of my shirt at night.

MR. BUGBEE: Actually, that is true. When we define any method we are considering the tools, the speed, the lay-out and such. Any change in the degree of the angle of your cutting tool, any change in the feed, any change in the speed, any change in the work-place lay-

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out, any change in the material—any change that affects the method as such, if that is properly recorded then you are in a position to re-evaluate your standard and show the new standard. If you do not have that all recorded and controlled, you will not be able to set proper standards. I agree that no one man is going to be able to beat the game of some of these operators unless you lock your machine and rigidly control it. And if you don't have a maximum speed in there, they are going to get your maximum speed at the expense of the tooling and the equipment.

CHAIRMAN BENNINGTON: I would like to thank you, Mr. Bugbee, for a very able presentation of a difficult topic and in a short time. And thank you, gentlemen, for your attention.

Aluminum Sheathed Cables

(*Continued from page 687*)

carbonic acid, fatty acids, ammonia (gas or liquid), ammonium sulphide, sodium bicarbonate, potassium permanganate, nitrates, sulphates, steam, water (distilled or tap). Hydrogen sulphide, oxygen, nitrogen, sulphur, sulphur dioxide, phenols, benzene, toluene, xylene. Most foodstuffs including beer, butter, fats, gelatine, milk, oils, sugar, vinegar. All oils, asphalts and petroleum products, organic solvents except chloroform, inks, rubber and rubber solutions, carbon disulphide, urea, coal gas.

(B) Slight Surface Attack May Occur, But Effects Are Not Serious in:

Chromic acid, nitric acid, sulphuric acid, sulphurous acid, fruit acids and most organic acids. Ammonium hydroxide, ammonium salts including the fluoride, bisulphates, arsenates, chromates, nitrates, sodium chloride (neutral). Sodium silicate, sea water, hydrogen peroxide, ozone, nitrous fumes, alcohols, crude tar and derivatives, petrol containing tetra ethyl lead, camphor, refrigerants, tanning solutions, borax.

(C) Serious Corrosion Occurs in Contact With:

Hydrochloric acid, hydrofluoric acid, phosphoric acid, formic acid, caustic alkalies and alkali carbonates, fluorides, chlorides, bromides and iodides. Mercury, mercury and certain lead salts, bleaching solutions, chlorinated water, fluorine, aniline, chloroform, methyl chloride.

(D) Important Note

These are general remarks and it would appear that with certain specific exceptions the greatest contributory factor in the corrosive mechanism is the presence of a halogen. Chloride as an impurity can accelerate corrosion enormously, as can dissimilar metal contact. The foregoing remarks apply to the metal where the usual precautions against such contacts have been taken.

It should be noted that cable sheaths rarely encounter any of the above materials in the pure state but more usually when they are contaminated with impurities which may completely change their behaviour. An example is sulphur dioxide, which when dry has no effect, when damp produces slight corrosion, and when associated with soot can produce severe attack.

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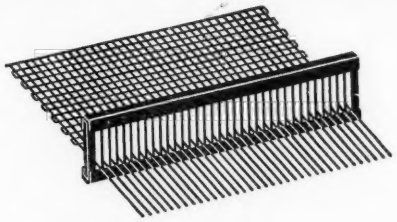

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The Montreal Regional Meeting

(*Continued from page* 691)

Following the dinner the guests were welcomed to the City by His Worship, the Mayor of Montreal, Camillien Houde, who portrayed the history and fine points of his lovely city. L. C. Crewe, Jr., President of the Association, then expressed his pleasure and gratification at the fine turn-out for the meeting.

★ ★ ★

The principal speaker of the evening was J. Lance Rumble, General Manager of the GMC Truck Retail Branch of General Motors Products, Canada, Ltd., of Toronto. His talk, "Rambling with Rumble", was both witty and informative. It was well—delivered and received. Mr. Rumble discussed those essentials of business that make for success.

★ ★ ★

Fred Crapo, past-president of the Association then rose to express the groups' appreciation to Mr. Rumble for his fine address.

★ ★ ★

At 9:30 P. M., those who were able to, after the strenuous tours of the afternoon, repaired to the Normandie Room for dancing.

The Technical Sessions
Friday, May 8, 1953

A program of unusual excellence had been arranged to occupy the entire day.

★ ★ ★

The first paper in the morning was "Methods-Time Management," given by R. L. Bugbee, Leetham-Simpson, Ltd., Montreal, with Paul W. Bennington, Chief Industrial Engineer of the Steel Company of Canada, Hamilton, acting as Chairman.

★ ★ ★

He was followed by W. A. Barnes, Vice President of the Utica Drop Forge and Tool Company, Utica, N. Y., who delivered a paper entitled "Applications of Koldwelding", followed by demonstrations. For this session Taylor Cornelius, Assistant General Manager of the Aluminum Company of Canada, Montreal, served as Chairman.

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The next paper was "Shaving for Non-Ferrous Wires as Practised by Canadian General Electric Company", delivered by G. J. Moher, Manager of Methods, Wire and Cable Section, Canadian General Electric Company, Peterborough. Hugh B. Carnahan, Assistant to the Vice President, Canada Wire and Cable Company, Toronto, was Chairman of the session.

★ ★ ★

In the afternoon two simultaneous sessions were held, one for Ferrous men and the other for Non-Ferrous men. For the first group a symposium, Inhibitors vs. Accelerators, was held with the following panel members: W. Billingsley, Canadian Industries, Ltd., Montreal; J. T. Irwin, Poor and Company, Waukegan, Ill.; and Alfred Douty, American Chemical Paint Company, Ambler, Pa. Allan B. Dove served as moderator.

★ ★ ★

For the second group J. P. Croft, Chief Engineer, Canada Wire and Cable Company, Toronto, delivered a paper entitled "Aluminum Sheathed Cables".

★ ★ ★

All papers and the discussions that followed each appear elsewhere in this issue, except the discussions resulting from the symposium, which are scheduled for printing in the August issue of this publication.

★ ★ ★

At the close of these technical sessions, at 4:30 P. M., two excellent sound-motion pictures were shown depicting operations at Noranda and the Steel Company. These films officially ended the two full and busy days at Montreal.

The Ladies

For the ladies who had come to Montreal with their men-folk, there was a luncheon on Thursday arranged for by Mrs. Allan Dove. On Friday, during the Technical Sessions, they were taken on a bus tour that covered the principal points of interest in and about Montreal. There were approximately 30 who participated in these functions.

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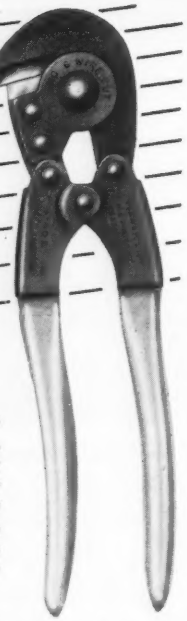

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Conclusion

The Committee is to be congratulated on the high calibre and quality of every feature of the program. They packed into the program more than usual, but the planning had been done well and every minute of the two-day meeting ran smoothly and efficiently. It was a splendid convention and one that will long be remembered favorably.

Revitalization of Old New England Wire Machinery Concern

(*Continued from page* 694)

was possible in the old foundry. The pattern storage system was reorganized and all patterns are cataloged and stored for maximum accessibility thus saving considerable time over the previous system of hunt and find.

★ ★ ★

Two of the major achievements which were started in 1945 are well on their way towards completion and involved a very considerable capital investment.

★ ★ ★

The first involved complete redesign and re-tooling for production of the Butt Line of braiding machines. In braiders, for instance, there are ball-bearings supplanting plain ones, accurately milled and spaced horn gear slots, milled carrier hearts and drive stems, precision milled top plates with increased wearing surfaces and other features that assure longer life and higher speeds with large packages of yarn as used today.

★ ★ ★

The second involved doing a similar redesign and re-tooling job on the complete Butt Line of tube stranders, cablers both rigid and planetary, bunchers, taping heads and take-ups. The original Butt machines employed cast iron wherever possible and were heavy slow speed machines. Today speed and functional improvements are of the utmost importance in all types of wire machinery. These new designs employ steels of various compositions and heat treatments to meet the requirements of safety, rigidity and reduced rotating

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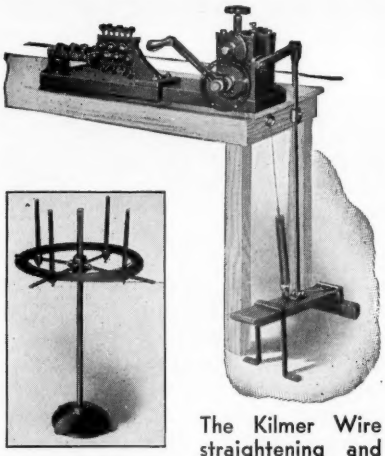

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masses required for smooth operation at high speeds. Every design detail was studied not only in light of the above requirements but also from the standpoint of precision manufacture which is a must in building all types of high speed machinery.

★ ★ ★

These were bold and expensive steps but they are already paying off in economical production and customer satisfaction. New and modern production equipment plus good engineering and sound management are essential. Less than 20% of their production equipment is over seven years old, with more machine tools still to come to lower the ratio.

★ ★ ★

Thus has an old American industrial landmark been revitalized. It bears little resemblance to the previous sprawling shop. New England Butt has gone modern, but in so doing has preserved a fine old tradition—and a lot of jobs.

J. & L. Introduces New Wire Rope with Coiled Spring Core

A new principle in wire rope construction, which engineers believe will solve a 50-year-old problem in deep-well drilling, was announced recently by **Jones & Laughlin Steel Corporation.**

★ ★ ★

The new principle employs the ability of the coiled spring to flex and to resist crushing.

★ ★ ★

The result is a wire rope with a core that is a coiled steel spring. No wire rope previously manufactured has employed this principle.

★ ★ ★

Development of the new product, designed for use in rotary drilling rigs, was begun ten years ago at J&L's Wire Rope Division plant at Muncy, Pa., under the supervision of Peter P. Somerville, general manager of the division.

★ ★ ★

This was undertaken at the urging of oil and gas well drillers in the great southwestern oil and gas industry.

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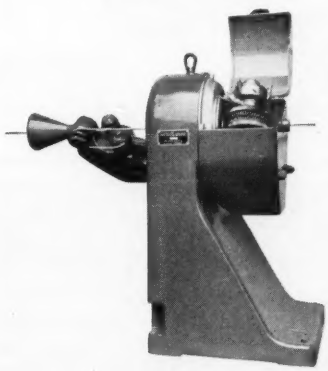

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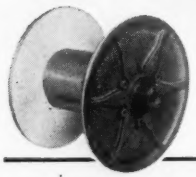

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The new rope is now in production at Muncy. The steel for the rope's strands, and for the spring center, comes from J&L's Aliquippa, Pa., Works.

★ ★ ★

J&L showed the new spring-center wire rope to the public for the first time at the International Petroleum Exposition in Tulsa, May 14th-23rd.

★ ★ ★

Spring-center wire rope is the second innovation in wire rope manufacture introduced by J&L in recent weeks. The first, announced on April 14th, was J&L plastic-core wire rope, which uses a core of solid plastic. This plastic-core wire rope was engineered for use in the cable tool method of drilling oil and gas wells. The spring-center wire rope was engineered for use in rotary drilling rigs.

Reynolds Metals to Add Hydraulic Extrusion Press

Hydropress, Inc., New York, has received an order for two Self-Contained Oil-Hydraulic Extrusion Presses from the Reynolds Metals Company in Richmond, Virginia. These presses are of the latest design enabling this company to extend its extrusion operations. This decision by one of the major aluminum companies is another indication of the growing interest of the industry in the extrusion market.

Alloy Steel Springs

A paper of the above title, 18 pages, with charts, tables and photo-micrographs, has been published by **International Nickel Co.** It compares the mechanical properties of three alloy steels, nickel-chromium-molybdenum (AISI 6150), and silico-manganese (AISI 9262) with plain carbon spring steel (AISI 1095). The conclusion is that, for exacting spring service, adequate hardenability, good surface, excellent mechanical properties, light decarburization, and cleanliness together with reasonable cost combine to make the nickel-chromium-molybdenum alloy steel the one to be employed.

★ ★ ★

For copies, please write International Nickel Co., 67 Wall St., New York 5, N. Y.

New Tantalex Capacitors Feature Very Low Leakage

First of a new line of tantalum electrolytic capacitors made by the **Sprague Electric Co.,** the 100D Tantalex, has been announced

★ ★ ★

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★ ★ ★

Bulletin 350, showing sizes, ratings, and performance data, will be sent upon letterhead request to Sprague Electric Company, 207 Marshall Street, North Adams, Mass.

★ ★ ★

Note: "Tantalex" is a registered trademark of the Sprague Electric Company.

Welding, Brazing, Soldering of Aluminum Detailed in New Manual

Engineers familiar with the welding of the older metals will find all they need to know about welding, brazing, and soldering aluminum in the new 186-page process manual, "WELDING ALUMINUM," just published by Reynolds Metals Company, Louisville, Ky.

★ ★ ★

This is a new and greatly enlarged edition of the manual by the same title originally published by Reynolds in 1946. The new edition contains material on 34 processes suitable for welding, brazing, and soldering aluminum and its alloys. These processes are shown in a large chart revealing their relation to one another and indicating those processes most widely used.

★ ★ ★

A second chart breaks down the wrought aluminum alloys and shows the various joining methods suitable for the various alloys. A third chart covers the aluminum casting alloys in a similar manner.

★ ★ ★

Another new development that has created much interest recently is "cold" welding . . . one of the two methods of "pressure" welding discussed in the Reynolds manual.

★ ★ ★

This 186-page manual is ring bound to lie flat when open; is convenient 6 x 9-inch pocket size. It contains more than 125 charts and illustrations. It will be sent without charge to any engineer, designer, technical man or company executive requesting it on company letterhead. To others, the price is $1.00 per copy. Write Desk PR, Reynolds Metals Company, 2500 South Third Street, Louisville 1, Kentucky.

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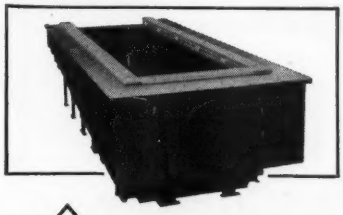

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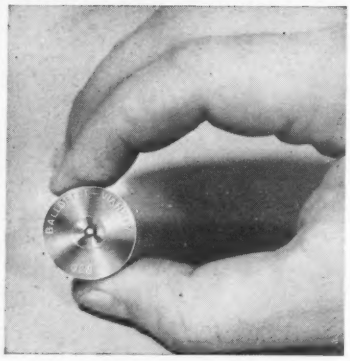

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Canadian Concern Sold to British Firm

On April 30th, 1953, the rod mill and wire and cable business of **Phillips Electrical Works Limited** was sold to **British Insulated Callendar's Cables Limited** of London, England.

★ ★ ★

A new company which has been formed that will be known as **Phillips Electrical Company (1953), Limited,** will continue to operate in the present Brockville and Montreal plants.

★ ★ ★

The telephone manufacturing operation of Phillips Electrical Works Limited will temporarily continue in Brockville and Montreal Plants of Phillips Electrical Company (1953) Limited. These operations, on an expanded basis, will be transferred as soon as prac-

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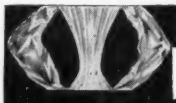

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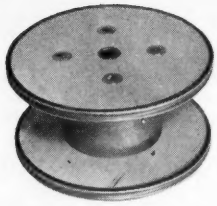

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★ ★ ★

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Bulletin on New Protective Coating for Aluminum

American Chemical Paint Co., Ambler, Pa., has issued a technical bulletin announcing a new protective coating for aluminum surfaces.

★ ★ ★

The process, using a new and improved "Alodine," recently developed by ACP chemists, is fully described, together with the equipment required for pre-cleaning, rinsing, alodizing, etc.

★ ★ ★

A copy of this bulletin will be mailed to interested readers upon request to the company.

New Die Price List Issued

Carboloy Dept., General Electric Company, Detroit 32, Mich., has issued a new bulletin containing two announcements: (1) their reduced prices on wire drawing and other dies and (2) their expanded line of dies.

★ ★ ★

The price list covers round, square and hex dies, mandrels, mandrel nibs, guide rings and guide bushings. Prices all went into effect May 18th.

★ ★ ★

For a copy, write to Carboloy for their Die Price List D-133.

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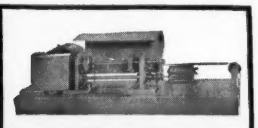

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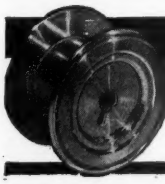

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Booklet on Plastic Construction Materials

Atlas Mineral Products Company, Mertztown, Pa., announces the availability, without charge, of a 35-page booklet on plastic materials of construction. This material which has been prepared specifically for corrosion engineers is now being expanded and will be published in book form later this year.

G.E. Establishes Warehouse to Serve Midwest on Silicone Products

Increased demand for silicone products by mid-western industries has led to the establishment of a warehouse for rapid delivery of the new chemical materials produced by the **General Electric Company's Silicone Products Department** at Waterford, N. Y. according to an announcement by Robert J. Baumann, department sales manager.

★ ★ ★

Located at 427 West Erie Boulevard in Chicago, the warehouse is stocking G-E silicone rubber gums and compounds, fluids for waxes and polishes, resins, electrical insulation, emulsions for mold release purposes, and a variety of other silicone materials.

★ ★ ★

The new facilities are described as a General Electric service to mid-western rubber fabricators, electrical manufacturers, wax and polish companies and other concerns who require rapid deliveries of silicones.

★ ★ ★

The company has similar warehouses at Anaheim, California; Cleveland, Ohio, and Waterford, N. Y. The service here will be under the supervision of the General Electric silicone sales offices at 840 South Canal Street.

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Metal Carbides Opens Two New Branch Offices

The Metal Carbides Corporation, Youngstown, Ohio, announces the opening of a Sales Office at 325 Bankers Trust Building, Indianapolis, Indiana, with **Mr. Frank C. Thompson, Jr.,** appointed as resident Sales Engineer.

★ ★ ★

And at 743 North 4th Street, Milwaukee, Wisconsin, another office has opened with **Mr. Charles Roman** appointed as resident Sales Engineer.

★ ★ ★

Mr. Fred Winter, Jr., has been appointed as Sales Engineer at the Boston, Massachusetts, Sales Office.

Folder on Die Finishing Tool

A new Nord, triple-purpose, filing, honing, lapping, polishing, tool sharpening and sawing machine, makes hand work 50 times faster. For new color folder illustrating and describing the Nord-Di-Profiler, write to **Nord International Corp.,** P.O. Box 44-N247, Denville, N. J.

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COPHOLDERS—Steel
Apco Mossberg Co., Attleboro, Mass.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Wire & Textile Mach'y, Inc. (used) Pawtucket. R. I.

CORDS—Electrical, Tinsel Conductor
Montgomery Co., The, Windsor Locks, Conn.

CORROSION PREVENTIVE PAPERS—
Angier Corporation, The, Framingham, Mass.

CRANES—Wire Mill
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, O.
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

CUTTING TOOLS—Carbide
Carboloy Dept. of General Electric Co., Detroit.
Eastern Carbide Corp., New Rochelle, N. Y.
Firth Sterling, Inc., Pittsburgh, Pa.
Metal Carbides Corporation, Youngstown, Ohio
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Vascoloy-Ramet Corp., North Chicago, Ill.

CUTTING TOOLS—Wire
Manco Manufacturing Co., Bradley, Ill.
Porter, H. K. Inc., Somerville, Mass.

DIAMONDS—Industrial
Balloffet-Vianney Wire Die Co., Inc., Guttenberg, N. J.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Wayne Wire Die Co., Hillside, N. J.

DIAMOND POWDERS—
Danforth, The C. W. Co., Youngstown, Ohio
Elgin National Watch Co., Abrasive Div., Elgin. Ill.
Hyprez Div., Engis Equipment Co., Chicago, Ill.
Indiana Wire Die Co., Ft. Wayne, Ind.
Industrial Diamond Powders, New Kensington, Pa.
National Research Company, St. Clair Shores, Mich.
New England Wire Die Co., Worcester, Mass.
Roux Wire Die Works, Inc., Oriskany, N. Y.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Universal Wire Die Co., Cranford, N. J.
Wayne Wire Die Co., Hillside, N. J.

DIAMOND POWDER RECLAIMING—
Boulin, Victor J., Inc., New York, N. Y.
Danforth, The C. W. Co., Youngstown, Ohio
Industrial Diamond Powders, Inc., New Kensington, Pa.
National Research Co., St. Clair Shores, Mich.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.

DIAMOND TOOLS—
Carboloy Dept. of General Electric Co., Detroit.
Indiana Wire Die Co., Ft. Wayne, Ind.
Metal Carbides Corporation. Youngstown, Ohio
Nord International Corp., Denville, N. J.
Roux Wire Die Works, Inc., Oriskany, N. Y.
Universal Wire Die Co., Cranford, N. J.
Wayne Wire Die Co., Hillside, N. J.

DIES—Carbide, Tungsten & Tantalum
Balloffet-Vianney Wire Die Co., Inc., Guttenberg, N. J.
Boulin, Victor J., Inc., New York, N. Y.
Carboloy Dept. of General Electric Co., Detroit.
Continental Carbide Die Co., Lyndhurst, N. J.
Eastern Carbide Corp., New Rochelle, N. Y.
Firth Sterling, Inc., Pittsburgh, Pa.
Indiana Wire Die Co., Fort Wayne, Ind.
Kelly Wire Die Corp., New York, N. Y.
Metal Carbides Corp., Youngstown, O.
Rayaloy Carbide Corp., New York, N. Y.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Universal Wire Die Co., Cranford, N. J.
Vascoloy-Ramet Corp., North Chicago, Ill.
Wayne Wire Die Co., Hillside, N. J.

DIES—Cold Heading
Carboloy Dept. of General Electric Co., Detroit.
Continental Carbide Die Co., Lyndhurst, N. J.
Eastern Carbide Corp., New Rochelle, N. Y.
Firth Sterling, Inc., Pittsburgh, Pa.
Indiana Wire Die Co., Ft. Wayne, Ind.
Metal Carbides Corporation, Youngstown, Ohio
Rayaloy Carbide Corp., New York, N. Y.
Vascoloy-Ramet Corp., No. Chicago, Ill.

DIES—Diamond
Ajax Industrial Supplies, Inc., Fort Wayne, Ind.
Balloffet-Vianney Wire Die Co., Inc., Guttenberg, N. J.
Boulin, Victor J., Inc., New York, N. Y.
Cochaud Wire Die Corp., New York, N. Y.
Ft. Wayne Wire Die, Inc., Fort Wayne, Ind.
Indiana Wire Die Co., Ft. Wayne, Ind.
Kelly Wire Die Corp., New York, N. Y.
New England Wire Die Co., Worcester, Mass.
North American Philips Co., Inc., Elmet Div., Lewiston, Me.
Roux Wire Die Works, Inc., Oriskany, N. Y.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Universal Wire Die Co., Cranford, N. J.
Wayne Wire Die Co., Hillside, N. J.

DIES—Extrusion
Carboloy Dept. of General Electric Co., Detroit.
Continental Carbide Die Co., Lyndhurst, N. J.
Eastern Carbide Corp., New Rochelle, N. Y.
Firth Sterling, Inc., Pittsburgh, Pa.
Metal Carbides Corporation, Youngstown, Ohio
Rayaloy Carbide Corp., New York, N. Y.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Universal Wire Die Co., Cranford, N. J.
Wayne Wire Die Co., Hillside, N. J.

DIES—Eyelet
Eastern Carbide Corp., New Rochelle, N. Y.
Kelly Wire Die Corp., New York, N. Y.

DIES—Nail, Nail Cutters, Feeder Blocks, Grippers, etc.
Pittsburgh Carbide Die Co., Monongahela, Pa.

DIES—Pointing
Sjogren Tool and Machine Co., Auburn, Mass.

DIES—Repairs & Re-Cutting
Ajax Industrial Supplies, Inc., Fort Wayne, Ind.
Balloffet-Vianney Wire Die Co., Inc., Guttenberg, N. J.
Boulin, Victor J., Inc, New York, N. Y.
Carboloy Dept. of General Electric Co., Detroit.
Cochaud Wire Die Corp., New York, N. Y.
Continental Carbide Die Co., Lyndhurst, N. J.
Eastern Carbide Corp., New Rochelle, N. Y.
Firth Sterling, Inc., Pittsburgh, Pa.
Ft. Wayne Wire Die., Inc., Fort Wayne, Ind.
Indiana Wire Die Co., Ft. Wayne, Ind.
Kelly Wire Die Corp., New York, N. Y.
Metal Carbides Corporation, Youngstown, Ohio
New England Wire Die Co., Worcester, Mass.
North American Philips Co., Inc., Elmet Div., Lewiston, Me.
Rayaloy Carbide Corp., New York, N. Y.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Universal Wire Die Co., Cranford, N. J.
Vascoloy-Ramet Corp., North Chicago, Ill.
Wayne Wire Die Co., Hillside, N. J.

DIES—Special Shapes, Etc.
Continental Carbide Die Co., Lyndhurst, N. J.
Eastern Carbide Corp., New Rochelle, N. Y.
Firth Sterling, Inc., Pittsburgh, Pa.
Indiana Wire Die Co., Ft. Wayne, Ind.
Murex, Ltd., Rainham, England
Rayaloy Carbide Corp., New York, N. Y.

DIES—Swaging
Murex, Ltd., Rainham, England
Rayaloy Carbide Corp., New York
Sjogren Tool and Mach. Co., Inc., Auburn, Mass.

DIES—Tube Drawing
Balloffet-Vianney Wire Die Co., Inc., Guttenberg, N. J.
Carboloy Dept. of General Electric Co., Detroit.
Continental Carbide Die Co., Lyndhurst, N. J.
Eastern Carbide Corp., New Rochelle, N. Y.
Firth Sterling, Inc., Pittsburgh, Pa.
Indiana Wire Die Co., Fort Wayne, Ind.
Kelly Wire Die Corp., New York, N. Y.
Metal Carbides Corp., Youngstown, O.
Murex, Ltd., Rainham, England
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Vascoloy-Ramet Corp., North Chicago, Ill.

DRAW BENCHES—
(See MACHINERY—Draw Benches)

DRUMS & TRAVERSES—Flange Steel
Entwistle, Jas. L. Co., Providence, R. I.
Republic Steel Corp., Pressed Steel Div., Niles, Ohio

DRYING EQUIPMENT
Carl-Mayer Corp., The, Cleveland, Ohio
Industrial Ovens, Inc., Cleveland, Ohio.
Rockwell, W. S. Co., Fairfield, Conn.

ENGINEERS—Consulting
Metal Fatigue—Fatigue of Materials Laboratory, Princeton, N. J.
Wire Insulating and Rubber and Plastics Processing—Hale and Kullgren, Inc., Akron, Ohio
Zinc—Imhoff, Wallace G., Co., No. Highlands, Calif.

EYELETS—Brass or Zinc
Platt Bros. & Co., The, Waterbury, Conn.

FENCING & FENCES—Wire
Interlocking Fence Co., Morton, Ill.

WHERE TO BUY, Continued

For more complete information, consult the annual Wire and Wire Products Buyers' Guide.

FOAM PRODUCING COMPOUNDS—
American Chemical Paint Co., Ambler, Pa.
Parkin Chemical Co., The, Pittsburgh, Pa.

FURNACES—Brazing
Electric Furnace Co., Salem, Ohio
Harper Electric Furnace Corp., Buffalo, N. Y.
Rockwell, W. S. Co., Fairfield, Conn.
Westinghouse Electric Corp., Industrial Heating Div., Meadville, Pa.

FURNACES—Galvanizing Equipment
Ajax Electric Co., Inc., Philadelphia, Pa.
Electric Furnace Co., Salem, Ohio
Holden, A. F. Co., The, Detroit, Mich.
Rockwell, W. S. Co., Fairfield, Conn.
Surface Combustion Corp., Toledo, Ohio
Trauwood Engineering Co., The, Cleveland, Ohio
Wilson, Lee, Engr. Co., Cleveland, Ohio

FURNACES—Heat Treating
Ajax Electric Co., Inc., Philadelphia, Pa.
Carl Mayer Corp., The, Cleveland, Ohio
Electric Furnace Co., Salem, Ohio
Holden, A. F., Co., The, Detroit, Mich.
Morrison Industries, Cleveland, Ohio
Rockwell, W. S., Co., Fairfield, Conn.
Surface Combustion Corp., Toledo, Ohio
Trauwood Engr. Co., Cleveland, Ohio
Westinghouse Electric Corp., Industrial Heating Div., Meadville, Pa.
Wilson, Lee, Engr. Co., Cleveland, Ohio

FURNACES—Lead Melting
Electric Furnace Co., Salem, Ohio
Rockwell, W. S. Co., Fairfield, Conn.
Surface Combustion Corp., Toledo, Ohio
Westinghouse Electric Corp., Industrial Heating Div., Meadville, Pa.

FURNACES—Pot (oil, gas, electric)
Ajax Electric Co., Inc., Philadelphia, Pa.
Holden, A. F., Co., The, Detroit, Mich.
Westinghouse Electric Corp., Industrial Heating Div., Meadville, Pa.

FURNACES—Resistance Heating, Strand
(See Annealing Machines)

FURNACES—Salt Bath
Ajax Electric Co., Inc., Philadelphia, Pa.
Electric Furnace Co., Salem, Ohio
Holden, A. F., Co., The, Detroit, Mich.
Rockwell, W. S. Co., Fairfield, Conn.
Surface Combustion Corp., Toledo, Ohio
Westinghouse Electric Corp., Industrial Heating Div., Meadville, Pa.

GALVANIZING EQUIPMENT — (See MACHINERY—Galvanizing Wire)

GRINDERS—Roll
Norton Co., The, Worcester, Mass.

GUIDES—for Wire
Heany Industrial Ceramic Corp., New Haven, Conn.

HAMMERS—Nail Heading
Pittsburgh Carbide Die Co., Monongahela, Pa.

HAMMERS—Swaging
Sjogren Tool and Machine Co., Auburn, Mass.

HOOKS—Pickling & Liming
Youngstown Welding & Eng'g' Co., Youngstown, Ohio

HOISTS—Electric Travelling
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, Ohio

IMPREGNATING MATERIALS—
Solar Compounds Corporation, Linden, N. J.

INHIBITORS—Pickling
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Parkin Chemical Co., The, Pittsburgh, Pa.

INSULATING MATERIALS—
Belding Heminway, New York, N. Y.
Electronic Rubber Co., Stamford, Conn.
Glass Fibers, Inc., Toledo, Ohio
Heineman Corp., Oscar, Chicago, Ill.
Merrimac Paper Co., New York, N. Y.
New England Lacquer Co., E. Providence, R. I.
Solar Compounds Corporation, Linden, N. J.
Solar Varnish Corp., Linden, N. J.

INSULATING MATERIALS — Paper—For Electric Wire Cable
Merrimac Paper Co., New York, N. Y.
Solar Compounds Corporation, Linden, N. J.
Solar Varnish Corp., Linden, N. J.

LACQUERING SYSTEMS — See MACH.—Lacquering Electric Wire

LACQUERS—For Electric Wire
New England Lacquer Co., E. Providence, R. I.
Solar Compounds Corporation, Linden, N. J.

LAME—LAHN—
Montgomery Co., The, Windsor Locks, Conn.

LIME—
Warner Co., Philadelphia and Bellefonte, Pa.

LUBRICANTS — For Metal Cutting, Stamping and Drawing
Apex Alkali Products Co., Philadelphia, Pa.
Miller, R. H., Co., Inc., Homer, N. Y.
Nopco Chemical Co., Harrison, N. J.
Standard Industrial Compounds Co., Chicago.

LUBRICANTS—Wire Drawing
(See Compounds—Wire Drawing)

LUBRICANTS—Wire Rope
Swift & Co., Chicago, Ill.

LUMBER—Wire Mill, Carload shipments for lagging and car blocking
Canada Reels, Ltd., Bury, Que., Canada
North Anson Reel Co., No. Anson, Me.

MACHINERY—Armoring (Cable, Wire, Hose)
American Insulating Mach'y Co., Phila., Pa.
Sleeper & Hartley, Inc., Worcester, Mass.
Watson Machine Co., Paterson, N. J.
Wire & Textile Mach'y, Inc., (used), Pawtucket, R. I.

MACHINERY—Barbed Wire
Glader Machine Works, Chicago, Ill.
Wafios, Maschinenfabrik, Reutlingen 3, Wurtt., Germany
Wean Engineering Co., Cleveland, Ohio

MACHINERY—Bolts & Rivets
Meyer, Roth & Pastor Maschinenfabrik, Koln-Raderberg, Germany

MACHINERY—Braiding
Fidelity Machine Co., Inc., Philadelphia, Pa.
New England Butt Co., Providence, R. I.
Wardwell Braiding Mach. Co., Central Falls, R.I.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

MACHINERY—Bunching
Cook Manufacturing Co., The, Paterson, N. J.
Haskell-Dawes Machine Co., Philadelphia, Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Watson Machine Co., Paterson, N. J.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

MACHINERY—Bundling, Scrap
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Cable, Electric
American Insulating Mach'y Co., Phila., Pa.
Fidelity Machine Co., Inc., Philadelphia, Pa.
Haskell-Dawes Machine Co., Philadelphia, Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Capstans (See Machinery—Winding Wire)

MACHINERY—Chain Making
Meyer, Roth & Pastor Maschinenfabrik, Koln-Raderberg, Germany
Nilson, A. H. Machine Co., Bridgeport, Conn.
Wafios, Maschinenfabrik, Reutlingen 3, Wurtt., Germany

MACHINERY—Closing Rope
Watson Machine Co., Paterson, N. J.

MACHINERY—Coiling Rod
Vaughn Mach'y Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

MACHINERY—Cold Heading
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

MACHINERY—Copper Wire Drawing
Aetna-Standard Engineering Co., Pittsburgh.
American Insulating Mach'y Co., Phila., Pa.
Hale and Kullgren, Inc., Akron, Ohio
National Mach'y Exch. (Used), New York.
Syncro Machine Co., Perth Amboy, N. J.
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

MACHINERY—Covering Wire (See MACHINERY—Insulating Wire)

MACHINERY—Cutting
Eisler Engineering Co., Newark, N. J.
Lewis Machine Co., The, Cleveland, Ohio
Manco Manufacturing Co., Bradley, Ill.
Mettler Machine Tool, Inc., New Haven, Conn.
Porter, H. K., Inc., Somerville, Mass.
Wean Equipment Corp., Cleveland, Ohio

MACHINERY—Descaling Rod, Dry
Fisher Associates, New York, N. Y.

MACHINERY—Die Making
American Optical Co., Instrument Div., Buffalo, N. Y.
Boulin, Victor J., Inc., New York, N. Y.
Carboloy Dept. General Electric Co., Detroit, Mich.
Dykrex Corp., Roos Tool & Mfg. Div., Newark, N. J.
Firth Sterling, Inc., Pittsburgh, Pa.
Kelly Wire Die Corp., New York, N. Y.
Nord International Corp., Denville, N. J.
Wayne Wire Die Co., Hillside, N. J.

MACHINERY—Draw Benches
Morgan Construction Co., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.
Wartenweiler, Emilio, Milano, Italy

MACHINERY—Edging (See MACHINERY — Tandem Rolling and Edging Mills)

MACHINERY—Enameling
American Insulating Mach'y Co., Phila., Pa.
Cook Manufacturing Co., The, Paterson, N. J.
Industrial Ovens, Inc., Cleveland, Ohio

MACHINERY—Extruding
Aetna-Standard Engineering Co., Pittsburgh.
Davis-Standard Sales Corp., Mystic, Conn.
Hale and Kullgren, Inc., Akron, Ohio
National Rubber Machinery Co., Akron, Ohio
Royle, John, & Sons, Paterson, N. J.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

MACHINERY—Fence
Glader, Wm., Machine Works, Chicago, Ill.
Interlocking Fence Co., Morton, Ill.
Malmedie Maschinenfabrik, Dusseldorf, Germany
Wean Equipment Corp., Cleveland, Ohio

MACHINERY—Filament Coil Winding
Eisler Engineering Co., Newark, N. J.

MACHINERY—Flat Wire
Mettler Machine Tool, Inc., New Haven, Conn.
Torrington Mfg. Co., Torrington, Conn.
Wean Equipment Corp. Cleveland, Ohio

MACHINERY—Forming Wire
Baird Machine Co., Stratford, Conn.
Lendt & Co., Inc., New York, N. Y.
Nilson, A. H., Machine Co., Bridgeport, Conn.
Wafios, Maschinenfabrik, Reutlingen 3, Wurtt., Germany

MACHINERY—Galvanizing Wire
Sleeper & Hartley, Inc., Worcester, Mass.
Steel Equipment Co., Cleveland, Ohio
Vaughn Machinery Co., Cuyahoga Falls, O.
Wean Equipment Corp., Cleveland, O.
Wilson, Lee, Engr. Co., Cleveland, Ohio

MACHINERY—Gang Winders
Entwistle, Jas. L. Co., Providence, R. I.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Grinding
Norton Co., The, Worcester, Mass.

MACHINERY—Insulating Wire
Aetna-Standard Engineering Co., Pittsburgh, Pa.
American Insulating Mach'y Co., Phila., Pa.
Davis-Standard Sales Corp., Mystic, Conn.
Ets. Pourtier Frères, Romainville, France
Fidelity Machine Co., Inc., Philadelphia, Pa.
Hale and Kullgren, Inc., Akron, Ohio
National Rubber Machinery Co., Akron, Ohio
New England Butt Co., Providence, R. I.
Royle, John & Sons, Paterson, N. J.
Syncro Machine Co., Perth Amboy, N. J.
Wardwell Braiding Mach. Co., Central Falls, R.I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Knitting
Fidelity Machine Co., Inc., Philadelphia, Pa.

MACHINERY—Lacquering Electric Wire
American Insulating Mach'y Co., Philadelphia.
Industrial Ovens, Inc., Cleveland, O.

MACHINERY—Lock Washer
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Looms, Wire Weaving
Interlocking Fence Co., Morton, Ill.
Wafios, Maschinenfabrik, Reutlingen 3, Wurtt., Germany

MACHINERY—Material Handling
(See Material Handling Equipment)

MACHINERY—Measuring Wire & Cable
Davis Electric Co., Wallingford, Conn.
Durant Mfg. Co., Milwaukee, Wis.
Entwistle, Jas. L. Co., Providence, R. I.
New England Butt Co., Providence, R. I.
Standard Mill Supply Co., Pawtucket, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Nail and Tack
Baird Machine Co., The, Stratford, Conn.
Glader, Wm., Machine Works, Chicago, Ill.
Meyer, Roth & Pastor Maschinenfabrik, Koln-Raderberg, Germany
National Mach'y Exch. (Used), New York, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.
Wafios, Maschinenfabrik, Reutlingen 3, Wurtt., Germany

MACHINERY—Optical, for Dies
American Optical Co., Instrument Div., Buffalo, N. Y.

WHERE TO BUY, Continued

For more complete information, consult the annual Wire and Wire Products Buyers' Guide.

MACHINERY—Pickling
Chemsteel Construction Co., Pittsburgh, Pa.
Youngstown Welding & Eng'g. Co., Youngstown, Ohio

MACHINERY—Pin Making
Baird Machine Co., The, Stratford, Conn.

MACHINERY—Pointing
Aetna-Standard Engineering Co., Pittsburgh, Pa.
Hale and Kullgren, Inc., Akron, Ohio
Meyer, Roth & Pastor Maschinenfabrik, Koln-Raderberg, Germany
Morgan Construction Co., Worcester, Mass.
National Mach'y Exch. (Used), New York, N. Y.
Scudder, E. J., Fdry. & Mach. Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.
Wean Equipment Corp., Cleveland, Ohio

MACHINERY—Poultry Wire Fencing
Interlocking Fence Co., Morton, Ill.
Malmedie Maschinenfabrik, Dusseldorf, Germany
Wean Equipment Corp., Cleveland, O.

MACHINERY—Pre-Heater for Wire (for Extrusion of Plastics)
Industrial Ovens, Inc., Cleveland, Ohio
National Rubber Machinery Co., Akron, Ohio

MACHINERY—Re-Spoolers
Boyd & Sons Manufacturing Corp., Philadelphia, Pa.
Davis Electric Co., Wallingford, Conn.
Fisler Engineering Co., Newark, N. J.
Emory, Robert J., Co., Newark, N. J.
Entwistle, Jas. L. Co., Providence, R. I.
National Mach'y Exch. (Used), New York, N. Y.
Steel Equipment Co., Cleveland, Ohio
Vaughn Machinery Co., Cuyahoga Falls, O.
Watson Machine Co., Paterson, N. J.
Wean Equipment Corp., Cleveland, Ohio
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.
Wire Insulating Machy., Div. of Machinery Electrification, Inc., Worcester, Mass.

MACHINERY—Rod Mill
Morgan Construction Co., Worcester, Mass.
Wean Equipment Corp., Cleveland, Ohio

MACHINERY—Rolling Mill
Morgan Construction Co., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.
Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.
Wean Engineering Co., Cleveland, Ohio

MACHINERY—Rubber Insulating
Davis-Standard Sales Corp., Mystic, Conn.
National Rubber Machinery Co., Akron, Ohio
Royle, John & Sons, Paterson, N. J.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

MACHINERY—Spark Testing
Davis Electric Co., Wallingford, Conn.
Entwistle, Jas. L. Co., Providence, R. I.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

MACHINERY—Spring Making
Carlson Company, The, New York, N. Y.
Lendt & Co., Inc., New York, N. Y.
National Mach'y Exch. (Used), New York, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.
Wafios, Maschinenfabrik, Reutlingen 3, Wurtt., Germany
Wells, Frank L., Co., Kenosha, Wisc.

MACHINERY—Staple
Sleeper & Hartley, Inc., Worcester, Mass.
Wafios, Maschinenfabrik, Reutlingen 3, Wurtt., Germany.

MACHINERY—Straightening & Cutting
Kilmer, M. D., & Co., Cleveland, Ohio
Lewis Machine Co., The, Cleveland, Ohio
Medart Co., The, St. Louis, Mo.
Mettler Machine Tool Co., New Haven, Conn.
Meyer, Roth & Pastor Maschinenfabrik, Koln-Raderberg, Germany
National Mach'y Exch. (Used), New York, N. Y.
Wartenweiler, Emilio, Milano, Italy
Wells, Frank L., Co., Kenosha, Wisc.

MACHINERY—Stranding
Haskell-Dawes Machine Co., Philadelphia, Pa.
Hughesville Machine & Tool Co., Hughesville, Pa.
Maillefer S. A., Renens-Lansanne, Switzerland.
Milton Machine Works, Inc., Milton, Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Swaging
Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.

MACHINERY—Take-Up and Pay-Out
Aetna-Standard Engineering Co., Pittsburgh, Pa.
American Insulating Mach'y Co., Phila., Pa.
Davis Electric Co., Wallingford, Conn.
Davis-Standard Sales Corp., Mystic, Conn.
Hale & Kullgren, Inc., Akron, Ohio
Industrial Ovens, Inc., Cleveland, Ohio
Marshall-Richards Machine Co., Ltd., Crook County, Durham, England
Standard Mill Supply Co., Pawtucket, R. I.
Watson Machine Co., Paterson, N. J.
Wire Insulating Machy., Div. of Machinery Electrification, Inc., Worcester, Mass.

MACHINERY—Taping
American Insulating Mach'y Co., Phila., Pa.
Ets. Pourtier Frères, Romainville, France
New England Butt Co., Providence, R. I.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

MACHINERY—Testing, Physical
Scott Testers, Inc., Providence, R. I.

MACHINERY—Tinning Wire
American Insulating Mach'y Co., Phila., Pa.
Cook Manufacturing Co., The, Paterson, N. J.
Steel Equipment Co., Cleveland, Ohio
Syncro Machine Co., Perth Amboy, N. J.
Wean Equipment Corp., Cleveland, Ohio

MACHINERY—Tinsel Rolling Mills
American Insulating Mach'y Co., Phila., Pa.

MACHINERY—Trolley Wire
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Tube Mill, Cold Drawing
Aetna-Standard Engineering Co., Pittsburgh, Pa.
Hale & Kullgren, Inc., Akron, Ohio
Marshall-Richards Machine Co., Ltd., Crook County, Durham, England
Mettler Machine Tool, Inc., New Haven, Conn.

MACHINERY—Twinning
(See Mach.—Bunching)

MACHINERY—Twisters, Wire
Cook Manufacturing Co., The, Paterson, N. J.
Davis Electric Co., Wallingford, Conn.
Haskell-Dawes Machine Co., Philadelphia, Pa.

MACHINERY—Used
National Machinery Exchange, New York, N. Y.
Wire & Textile Machy., Inc., Pawtucket, R. I.

MACHINERY—for Wire Welding (See WELDERS—Butt and Spot)

MACHINERY—Winding Wire
Eisler Engineering Co., Newark, N. J.
Entwistle, Jas. L., Co., Providence, R. I.
New England Butt Co., Providence, R. I.
Standard Mill Supply, Pawtucket, R. I.
Watson Machine Co., Paterson, N. J.
Wire Insulating Machy., Div. of Machinery Electrification, Inc., Worcester, Mass.

MACHINERY—Wire Bending
Eisler Engineering Co., Newark, N. J.
Kilmer, M. D., & Co., Cleveland, Ohio

MACHINERY—Wire Drawing
Aetna-Standard Engineering Co., Pittsburgh, Pa.
Cook Manufacturing Co., The, Paterson, N. J.
Hale & Kullgren, Inc., Akron, Ohio
Herborn, Herborn, Germany
Marshall-Richards Machine Co., Ltd., Crook County, Durham, England
Morgan Construction Co., Worcester, Mass.
National Mach'y Exch. (Used), New York, N. Y.
Scudder, E. J., Fdry. & Mach. Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Steel Equipment Co., Cleveland, Ohio
Syncro Machine Co., Perth Amboy, N. J.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.
Wean Equipment Corp., Cleveland, Ohio

MACHINERY—Wire Forming
Baird Machine Co., The, Stratford, Conn.
Kilmer, M. D., & Co., Cleveland, Ohio
National Mach'y Exch. (Used), New York, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Wire Rope
Milton Machine Works, Inc., Milton, Pa.
New England Butt Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Wrapping with Paper
Angier Corporation, The, Framingham, Mass.
Lendt & Co., Inc., New York, N. Y.
Marshall-Richards Machine Co., Ltd., Crook County, Durham, England
Terkelsen Machine Co., Boston, Mass.

MATERIAL HANDLING EQUIPMENT—
Cleveland Tramrail Div. of The Cleveland Crane & Engineering Co., Wickliffe, O.

MILLS—Tandem, Rolling & Edging
Wean Equipment Co., Cleveland, Ohio

NAIL TOOLING—Tungsten Carbide
Firth Sterling, Inc., Pittsburgh, Pa.
Pittsburgh Carbide Die Co., Monongahela, Pa.

NAILS—Wire
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Keystone Steel & Wire Co., Peoria, Ill.
Wickwire Brothers, Inc., Cortland, N. Y.

OVENS—Cable Lacquering
American Insulating Mach'y Co., Phila., Pa.
Carl-Mayer Corp., The, Cleveland, Ohio.
Industrial Ovens, Inc., Cleveland, Ohio
Morrison Industries, Cleveland, Ohio
Westinghouse Electric Corp., Industrial Heating Div., Meadville, Pa.

OVENS—Rod Bakers
Carl-Mayer Corp., The, Cleveland, Ohio
Morrison Industries, Cleveland, Ohio

OVENS—Welding Rod Coating
Carl-Mayer Corp., The, Cleveland, Ohio
Industrial Ovens, Inc., Cleveland, Ohio
Morrison Industries, Cleveland, Ohio

PAINT—Acid Proof
Ceilcote Company, Cleveland, Ohio
Nukem Products Corporation, Buffalo, N. Y.

PAINT BONDING CHEMICALS—
American Chemical Paint Co., Ambler, Pa.

PAINTS—Heat Resisting
American Chemical Paint Co., Ambler, Pa.
Solar Compounds Corp., Linden, N. J.

PAPER—Creped Wrapping
Angier Corporation, The Framingham, Mass.
Terkelsen Machine Co., Boston, Mass.

PAPER—For Coil Wrapping and Corrosion Prevention
Angier Corporation, The, Framingham, Mass.
Terkelsen Machine Co., Boston, Mass.

PATENT ATTORNEYS—
Lancaster, Allwine & Rommel, Washington, D. C.

PAY-OUT SYSTEMS—(See MACHINERY—Take-Up & Pay-Out)

PHOSPHATE COATING CHEMICALS — (See COMPOUNDS — Phosphate Coating)

PICKLING COMPOUNDS—
See (Inhibitors—Pickling)

PICKLING—Hooks, etc. Acid Resisting
Youngstown Welding & Eng'g' Co., Youngstown, Ohio

PICKLING TANK LININGS—
Chemsteel Construction Co., Pittsburgh, Pa.
Haveg Corp., Newark, Del.
Heil Process Equipment Corp., Cleveland, Ohio
Nukem Products Corporation, Buffalo, N. Y.

PIPES & FITTINGS—Acid Resistant
Haveg Corp., Newark, Del.

POTS—Lacquer
Industrial Ovens, Inc., Cleveland, Ohio

PRESSES—Hydraulic and Mechanical
Aetna-Standard Engineering Co., Pittsburgh, Pa.
Hale & Kullgren, Inc., Akron, Ohio

PULLERS AND GRIPS—For Wire
Morgan Construction Co., Worcester, Mass.
Scudder, E. J. Fdry & Mach. Co., Trenton, N. J.
Sjogren Tool and Machine Co., Auburn, Mass.
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.
Wean Equipment Corp., Cleveland, Ohio

REEL AND TENSION STANDS—
Davis Electric Co., Wallingford, Conn.
Entwistle, Jas. L. Co., Providence, R. I.
Fidelity Machine Company, Inc., Philadelphia.
Industrial Ovens, Inc., Cleveland, Ohio
Kilmer, M. D., & Co., Cleveland, Ohio
Roll-A-Reel, Cincinnati, Ohio
Sleeper & Hartley, Inc., Worcester, Mass.
Standard Mill Supply Co., Pawtucket, R. I.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.
Wire Insulating Machy., Div. of Machinery Electrification, Inc., Worcester, Mass.

REEL CRUTCHES—
Roll-A-Reel, Cincinnati, Ohio

WHERE TO BUY, Continued

For more complete information, consult the annual Wire and Wire Products Buyers' Guide.

Watson Machine Co., Paterson, N. J.

REELS & SPOOLS—Aluminum Alloy
Acrometal Products, Inc., Minneapolis, Minn.
Milton Machine Works, Inc., Milton, Pa.

REELS & SPOOLS—Annealing and Stranding
Acrometal Products, Inc., Minneapolis, Minn.
Apco Mossberg Co., Attleboro, Mass.
Howsam Spool Co., Aurora, Ill.
Milton Machine Works, Inc., Milton, Pa.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Republic Steel Corp., Pressed Steel Div., Niles, Ohio

REELS—Metal Bound
Canada Reels, Ltd., Bury, Que., Canada
Durkee Mfg. Co., Pine River, Minn.
Howsam Spool Co., Aurora, Ill.
McCaskie, Inc., Wm., Westport, Mass.
North Anson Reel Co., No. Anson, Me.

REELS—Plywood
Carris Reels, Inc., Rutland, Vt.
Lavendier, Charles, Co., Inc., Pawtucket, R. I.
McCaskie, Inc., Wm., Westport, Mass.
Nelson Company, The, Baltimore, Md.
Winchester Reel Co., Ashuelot, N. H.

REELS & SPOOLS—Steel (All Types)
Acrometal Products, Inc., Minneapolis, Minn.
Apco Mossberg Co., Attleboro, Mass.
Clark, J. L. Mfg. Co., Rockford, Ill.
Howsam Spool Co., Aurora, Ill.
Mason Can Company, East Providence, R. I.
Milton Machine Works, Inc., Milton, Pa.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Republic Steel Corp., Pressed Steel Div., Niles, Ohio

REELS—Wire Mill
Acrometal Products, Inc., Minneapolis, Minn.
Apco Mossberg Co., Attleboro, Mass.
Bridge Mfg. Co., The, Hazardville, Conn.
Canada Reels, Ltd., Bury, Que., Canada
Carris Reels, Inc., Rutland, Vt.
Durkee Mfg. Co., Pine River, Minn.
Howsam Spool Co., Aurora, Ill.
Lavendier, Charles, Co., Inc., Pawtucket, R. I.
Mason Can Company, East Providence, R. I.
McCaskie, Inc., Wm., Westport, Mass.
Mettler Machine Tool, Inc., New Haven, Conn.
Milton Machine Works, Inc., Milton, Pa.
Mossberg Pressed Steel Corp., Attleboro, Mass.
North Anson Reel Co., No. Anson, Me.
Republic Steel Corp., Pressed Steel Div., Niles, Ohio
Winchester Reel Co., Ashuelot, N. H.

REELS & SPOOLS—Wooden
Acrometal Products, Inc., Minneapolis, Minn.
American Woodworking Co., Chicago, Ill.
Bridge Mfg. Co., Inc., The, Hazardville, Conn.
Canada Reels, Ltd., Bury, Que., Canada
Carris Reels, Inc., Rutland, Vt.
Durkee Mfg. Co., Pine River Minn.
Lavendier, Charles, Co., Inc., Pawtucket, R. I.
Nelson Company, The, Baltimore, Md.
North Anson Reel Co., No. Anson, Me.
Winchester Reel Co., Ashuelot, N. H.

REFRACTORIES—High Temperature
Norton Company, Worcester, Mass.

ROD BAKERS—(See Ovens—Rod Bakers)

RODS—Stainless Steel
American Steel & Wire Co., Cleveland, Ohio
Pittsburgh Steel Co., Pittsburgh, Pa.

RODS—Wire—Non-Ferrous
Platt Bros. & Co., The, Waterbury, Conn.

RODS—Wire, Steel
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Indiana
Erie Iron & Supply Corp., Erie, Pa.
Gerber, J., & Co., Inc., New York, N. Y.
Keystone Steel & Wire Co., Peoria, Ill.
Pittsburgh Steel Company, Pittsburgh, Pa.
Youngstown Sheet & Tube Co., Youngstown, O.

ROPE—Wire
American Steel & Wire Company, Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
Roebling's, John A. Sons Corp., Trenton, N. J.

RUST PROOF COMPOUNDS—
(See Compounds—Rust Preventing)

RUST REMOVING COMPOUNDS—
(See Compounds—Rust Preventing)

SALTS—Heat Treating, Descaling, etc.
Holden, A. F., Co., The, Detroit, Mich.

SATURATION SYSTEMS—
Industrial Ovens, Inc., Cleveland, Ohio
Watson Machine Co., Paterson, N. J.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

SOAPS—Industrial and Wire Drawing
(See Compounds—Wire Drawing)

SODIUM—for Descaling
Holden, A. F., Co., The, Detroit, Mich.

SPOOLS—(See Reels & Spools)

SPOOLS—Stamped Metal for Retail Wire Sales
Clark, J. L. Mfg. Co., Rockford, Ill.
Mason Can Co., East Providence, R. I.

STAMPINGS—Steel
Acrometal Products, Inc., Minneapolis, Minn.
Mossberg Pressed Steel Corp., Attleboro, Mass.

STRIP—Steel
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Roebling's, John A. Sons Corp., Trenton, N. J.
Youngstown Sheet & Tube Co., Youngstown, O.

TANKS—Compound
Watson Machine Co., Paterson, N. J.

TANKS—Pickling and Plating
Ceilcote Company, Cleveland, Ohio
Chemsteel Construction Co., Pittsburgh, Pa.
Nukem Products Corporation, Buffalo, N. Y.

TESTERS — INSULATION (See MACHINERY—Spark Testers)

TESTING EQUIPMENT (See MACHINERY Testing, Physical)

TINNING PROCESS—
Metal & Thermit Corp., New York, N. Y.

TINSEL—Electric Conductor
Montgomery Co., The Windsor Locks, Conn.

TINSEL WIRE—Resistance, Lame, Decorative Cords Thread—Bare Copper, Silver and False Gold Coated, etc. (See TINSEL—Electric Conductor)

TOOLS—Nail Machine
Pittsburgh Carbide Die Co., Monongahela, Pa.

TOOLS—Wire Cutting
Porter, H. K., Inc., Somerville, Mass.

TRAMRAIL SYSTEMS—
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, O.

TRANSMISSIONS—Variable speed (See Machy—Power Transmission)

TRAVERSES & DRUMS—For Reels
(See Drums & Traverses)

TRAVERSE MECHANISMS—
Apco Mossberg Co., Attleboro, Mass.
New England Butt Co., Providence, R. I.
Pressed Steel Div., Republic Steel Corp., Niles, Ohio
Watson Machine Co., Paterson, N. J.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.
Wire Insulating Machy., Div. of Machinery Electrification, Inc., Worcester, Mass.

TUBE BENDERS AND FORMERS—
Kilmer, M. D., & Co., Cleveland, Ohio

VALVES & FITTINGS—Acid Resistant
Haveg Corp., Newark, Del.

VARNISHES—for Electric Wire
N. E. Lacquer Co., E. Providence, R. I.
Solar Varnish Corporation, Linden, N. J.

VULCANIZING PANS AND EQUIPMENT—
American Insulating Mach'y Co., Phila., Pa.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Wire Insulating Machy., Div. of Machinery Electrification, Inc., Worcester, Mass.

WELDERS—Spot and Butt
Eisler Engineering Co., Newark, N. J.
Micro Products Co., Chicago, Ill.

WIRE—Aluminum
Elmet Division, North American Philips Company, Inc., Lewiston, Maine
Malin & Co., The, Cleveland, Ohio
Seneca Wire & Manufacturing Co., Fostoria, O.

WIRE—Barbed
Gerber, J., & Co., Inc., New York, N. Y.
Interlocking Fence Co., Morton, Ill.

WIRE—Brass
Chase Brass & Copper Co., Waterbury, Conn.
Spencer Wire Corp., Union, N. J.

WIRE—Brush
Gerber, J., & Co., Inc., New York, N. Y.
Spencer Wire Corp., Union, N. J.

WIRE—Cast
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Cold Heading
American Steel & Wire Co., Cleveland, Ohio
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind
Erie Iron & Supply Corp., Erie, Pa.
Gerber, J., & Co., Inc., New York, N. Y.
Keystone Steel & Wire Co., Peoria, Ill.
Pittsburgh Steel Co., Pittsburgh, Pa.
Roebling's, John A. Sons Corp., Trenton, N. J.
Seneca Wire & Manufacturing Co., Fostoria, O.
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Copper
Chase Brass & Copper Co., Waterbury, Conn.
Gerber, J., & Co., Inc., New York, N. Y.
Spencer Wire Corp., Union, N. J.

WIRE—Flat, Fine
Elmet Division, North American Philips Company, Inc., Lewiston, Maine
Gerber, J., & Co., Inc., New York, N. Y.
Montgomery Co., The, Windsor Locks, Conn.

WIRE—Forming
Erie Iron & Supply Corp., Erie, Pa.
Pittsburgh Cut Wire Co., Pittsburgh, Pa.

WIRE—Galvanized
Erie Iron & Supply Corp., Erie, Pa.
Gerber, J., & Co., New York, N. Y.

WIRE—Manufacturers
American Steel & Wire Co., Cleveland, Ohio
Bethlehem Steel Co., Bethlehem, Pa.
Chase Brass & Copper Co., Waterbury, Conn.
Continental Steel Corp., Kokomo, Ind.
Gerber, J., & Co., New York, N. Y.
Johnson Steel & Wire Co., Worcester, Mass.
Keystone Steel & Wire Co., Peoria, Ill.
National Lock Washer Company, The, Newark, N. J.
North American Philips Co., Inc., Elmet Division, Lewiston, Me.
Pittsburgh Steel Co., Pittsburgh, Pa.
Roebling's, John A. Sons Corp., Trenton, N. J.
Seneca Wire & Manufacturing Co., Fostoria, O.
Spencer Wire Corp., Union, N. J.
U. S. Steel Co., N. Y., N. Y.
Wickwire Brothers, Inc., Cortland, N. Y.
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Music
American Steel & Wire Co., Cleveland, Ohio
Johnson Steel & Wire Co., Inc., Worcester, Mass.
Malin & Co., The, Cleveland, Ohio
Seneca Wire & Manufacturing Co., Fostoria, O.
Specialty Wire Co., Inc., Worcester, Mass.
Spencer Wire Corp., Union, N. J.

WIRE—Nickel Silver and Phosphor Bronze
Chase Brass & Copper Co., Waterbury, Conn.
Malin & Co., The, Cleveland, Ohio

WIRE—Oil Tempered
Pittsburgh Steel Co., Pittsburgh, Pa.

WIRE—Special Shapes
Continental Steel Corp., Kokomo, Ind.
National Lock Washer Company, The, Newark, N. J.

WIRE—Spring
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Erie Iron & Supply Corp., Erie, Pa.
Gerber, J., & Co., New York, N. Y.
Johnson Steel & Wire Co., Inc., Worcester.
Keystone Steel & Wire Co., Peoria, Ill.
Pittsburgh Steel Co., Pittsburgh, Pa.
Seneca Wire & Mfg. Co., Fostoria, Ohio
Specialty Wire Co., Inc., Worcester, Mass.
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Stainless Steel
American Steel & Wire Co., Cleveland, Ohio
Firth Sterling, Inc., Pittsburgh, Pa.
National Lock Washer Company, The, Newark, N. J.
Pittsburgh Steel Co., Pittsburgh, Pa.
Specialty Wire Co., Inc., Worcester, Mass.

WIRE—Steel—Also Coppered and Galvanized Steel
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Erie Iron & Supply Corp., Erie, Pa.
Gerber, J., & Co., New York, N. Y.
Johnson Steel & Wire Co., Inc., Worcester, Mass.
Keystone Steel & Wire Co., Peoria, Ill.
Pittsburgh Steel Co., Pittsburgh, Pa.
Seneca Wire & Mfg. Co., Fostoria, Ohio
Spencer Wire Corp., Union, N. J.
U. S. Steel Export Co., New York, N. Y.
Wickwire Brothers, Inc., Cortland, N. Y.
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Straightening and Cutting
Erie Iron & Supply Corp., Erie, Pa.
Pittsburgh Cut Wire Co., Pittsburgh, Pa.
Wickwire Brothers, Inc., Cortland, N. Y.

WIRE—Tungsten
North American Philips Co., Inc., Elmet Division, Lewiston, Me.

WIRE—Zinc
Platt Bros. & Co., The, Waterbury, Conn.

WRAPPING PAPER—Creped (See PAPER—Creped Wrapping)

YARNS & TAPES—
Belding Heminway, New York, N. Y.
Glass Fibers, Inc., Toledo, Ohio

YARN TESTERS—
Heineman Corp., Oscar, Chicago, Ill.
Scott Testers, Inc., Providence, R. I.

The WATSON MACHINE COMPANY

ESTABLISHED 1845

PATERSON 3, NEW JERSEY, U. S. A.

ELECTRICAL WIRE AND CABLE, WIRE ROPE, CORDAGE AND MASTICATING MACHINERY MANUFACTURERS

WATSON

PLANETARY STRANDERS. Three types, many sizes, for all duties, geared or ring backturn, main rotor shaft or roller support. "Shaftless" cradles.

RIGID FRAME STRANDERS "RH." Horizontal, overhung spindle designs. Ball bearing main rotor shaft support, no support rollers.

TUBULAR STRANDERS "TH." High speed type in all sizes. Patented Boat cradles and Tungsten Carbide guide system. Rotor and layhead electric stops.

TUBULAR STRANDERS "VL."—New design, safe extra high speeds. Quick loading. "Shaftless" no loose parts cradles.

CABLERS.

Planetary and high speed "HH" designs.

CLOSERS.

Planetary and high speed types for wire rope.

WATSON

BUNCHERS.

VERTICAL Minimum Floor Space Double-Twist Types "V-7" 250 # Cap. V-10 500 & 1000 # Cap.

ARMORING MACHINES. Complete with planetary wire or metal tape heads.

JUTERS. 36 or 48 cop and to 6-inch cable passage.

SERVING HEADS. Concentric and eccentric, many designs, for threads, asbestos, etc.

TAPING HEADS. Many types and sizes. For metallic and non-metallic tapes. Eccentric, single and double-concentric. Patented uniform torque tape brake.

COMPOUNDING AND SATURATING TANKS. Many types and sizes.

CHALK, MICA AND OTHER POWDER APPLIERS. "Wet and Dry" types in a variety of designs and sizes.

CAPSTAN SECTIONS. Single tapered wheels to 10 foot dia. and double grooved types to 80 inch dia. for heaviest duty and highest haul pulls. Many sizes and designs.

LET-OFF. Manual, mechanical, hydraulic, and electric motor lift types and "Shaftless" designs to 120-inch 30-ton sizes.

GANG SPOOLERS. Table and Floor types in many sizes and designs.

REWINDERS AND COILERS. All motorized, for warehouse and shipping use.

CAPSTAN TAKEUPS. Single and in multiples.

CONTINUOUS TAKEUPS. Double reel designs, constant tension, wide speed range to cover all Continuous Vulcanizing and plastic Extruding takeup requirements.

HEAVY DUTY TAKEUPS. "Shaftless" in many designs and sizes to 120"-50-ton. Mechanical lift, hydraulic lift, motorized lift, incline frame, and other types. Line shaft, electric, and hydraulic drives. Foot treadle, electric switch, pneumatic, hydraulic, and mechanical controls.

TAKEUP TRANSMISSIONS. Heavy Duty, Type "D." Combines two-speed transmission, manual slack-takeup drive, and multiple-disc-in-oil friction mechanism in one compact unit. Now available in three sizes.

AUTOMATIC TRAVERSES. Many sizes and arrangements. Wide lay range. Designs cover range from fine wire to 6" cable and wire rope. Fully automatic and disconnectible for manual operation. Suitable and widely used for replacement of inadequate mechanism on older takeups.

VULCANIZERS. Cavity and Plate "Patch" units. Mechanically or pneumatically operated. Available with or without dies.

POLISHERS. Power driven, centrifugal and spring-pressure types.

TESTING MACHINES. Impact, Torsion, Bend and Endurance types.

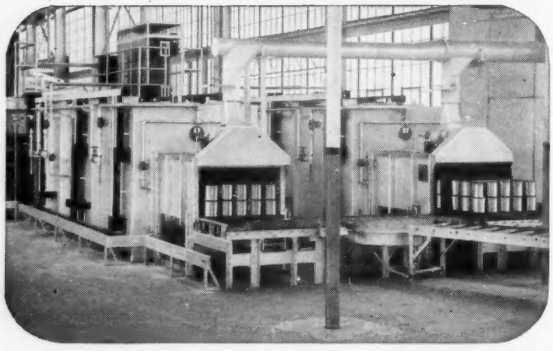
MEASURING MACHINES. For linear measurement. Offered in a variety of sizes and arrangements.

REEL CRUTCHES. For turning very large and heavy reels. Widely used in warehouses, shipping rooms, by railroads, steamship lines and wherever reel handling is a problem. Available from stock.

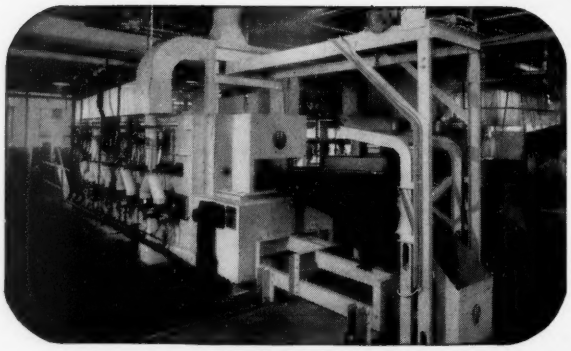
REELS AND SPOOLS. Cast Steel and Fabricated designs for extremely heavy planetary and shipping use.

CABLE PLANT AND WIRE ROPE MILL EQUIPMENT. All manners of special and miscellaneous designs for general and special purpose work too numerous for listing but on which inquiries are invited.

7-53



Bright annealing wire. EF gas-fired and electric furnaces are built in many sizes and types for bright annealing wire on spools or reels, in coils or strands—ferrous and non-ferrous, including stainless.

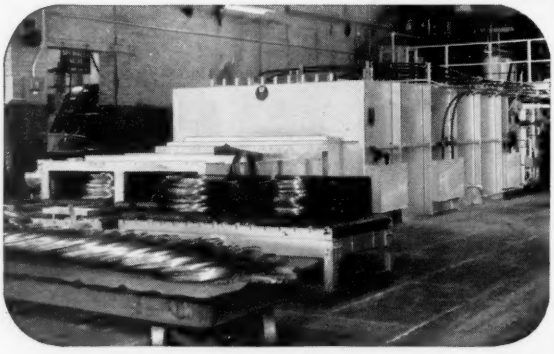


Bolts, springs and other products are scale-free heat treated in EF continuous chain belt conveyor furnaces similar to the above. 11 sizes—to handle from 125 to 2000 lbs. or more per hour. Hundreds are in operation.

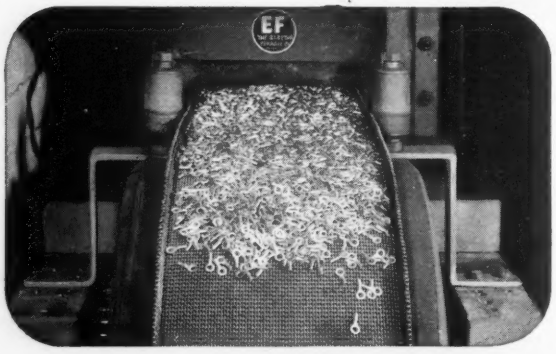
There's an EF

high efficiency production furnace

FOR EVERY annealing, heating or heat treating REQUIREMENT



An EF continuous bright annealing furnace in which the wire is conveyed through the various zones on two parallel rows of bulkhead-type trays. This unit has convection cooling and handles 2500 net lbs. of wire per hour.



EF woven wire mesh belt conveyor furnaces are available in various widths—for a wide variety of products—for drawing, annealing, sintering, brazing and other heating processes—at temperatures up to 2100° F.

• For heating wire bars and billets—process annealing or normalizing—bright annealing ferrous, non-ferrous, stainless or other alloy wire—in coils or strands—on reels or spools—also for carbon restoration and non-decarb heat treating bolts and other rod or wire products—bluing, or any other heat treating process—investigate EF developments.

Our long experience—and complete line of batch and continuous furnaces featuring the many advantages available only in EF design—assures efficient operation, uniformity of finished product and satisfactory performance. Sizes to meet any capacity requirement.

Gas-Fired, Oil-Fired EF and Electric Furnaces

for any Process, Product or Production

THE ELECTRIC FURNACE CO.

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